SIEMENS

SIMATIC HMI

Process Diagnosis ProAgent for OP

User's Manual

Contents

6AV3681-1AC05-1PB0

Issue 12/99

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Siemens Aktiengesellschaft

Order No. 6AV3681-1AC05-1PB0

Contents

Preface

1

Overview

This chapter explains how the manual is organized and where to find what information.

1.1 Guide to the Manual

Contents

This manual provides you with all the information you need to do the following:

- configure an installation-specific process diagnosis
- identify a process fault on the operating unit, locate the cause of the fault and eliminate it
- adapt the standard diagnosis screens to suit your own particular requirements

What You are Expected to Know Already

This manual assumes that you already have some general experience of configuring with ProTool. The information in this manual is therefore restricted to the description of functions and procedures that are part of ProAgent and are not among the standard range of functions provided by ProTool.

It also assumes that you have a basic knowledge of STEP 7.

Where to Find What

The chapters of this manual are arranged by topic as follows:

- The chapter **Installation** explains how to install the option package on your system under STEP 7 and ProTool.
- The chapter **Introduction** explains the benefits of process diagnosis and shows you how to locate a fault on the operating unit and rectify it. An overview shows the steps required for configuration and where the interfaces between STEP 7, ProTool and ProAgent are.

  At the end of the chapter, a number of important terms that are frequently encountered in the context of process diagnosis are explained.
- Installing the ProAgent option package adds a number of new menu options and functions to the basic ProTool program. The chapter **Effects on ProTool** show you what those new menu options and functions are and what purposes they have.
- The chapter **Display on the Operating Unit** explains how the individual diagnosis screens appear on the operating unit, what they show and what functions you can activate. This is information you need to know before you create your own projects.
- The chapter **Configuring in ProTool** then explains how to start configuring in ProTool yourself. It shows you how to incorporate a process diagnosis in a new project or how you can upgrade an existing project to include process diagnosis.
- The chapter **Message Processing** provides detailed information about the message number procedure ALARM_S which replaces the message bit procedure previously used in ProTool.
- The chapter **Modifying Diagnosis Screens** shows you how you can modify the diagnosis screens to suit specific requirements.
- Finally, the **Appendix** provides a reference section detailing all system messages that appear on the operating unit in the event of an error along with details of the possible causes and remedies.

  The Appendix also contains information about the system limits, that you must take into consideration in your project.

Other Sources of Information

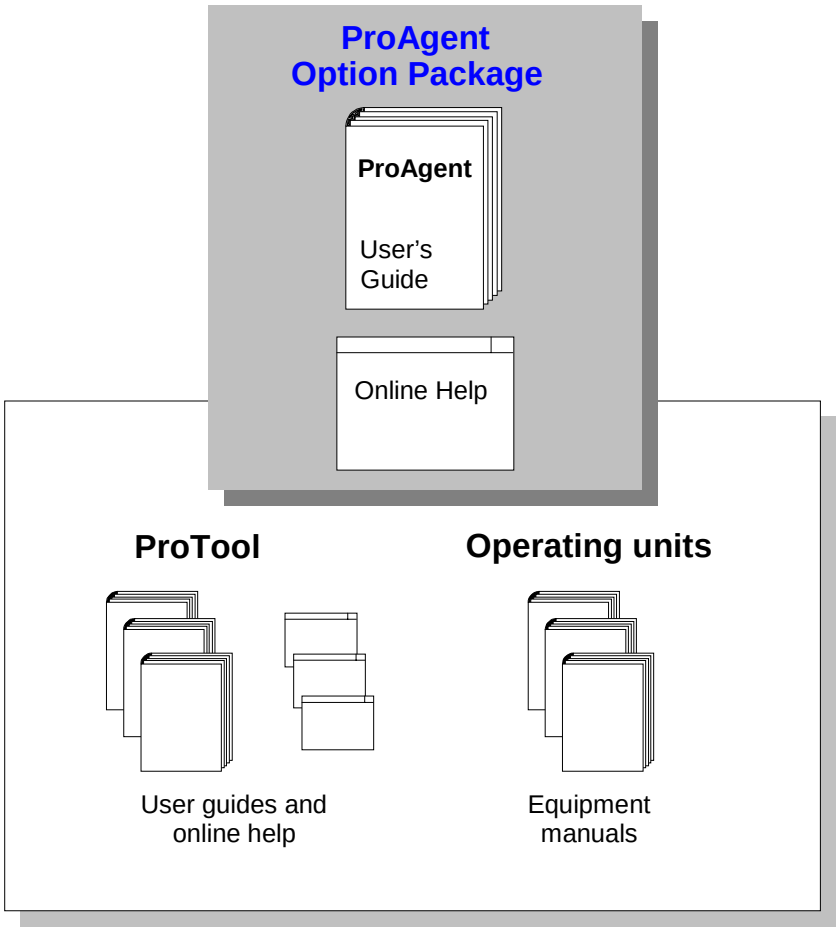
More reference information is available from the **Online Help**.

Note
With regard to the description of general ProTool functions, please also consult the *ProTool User's Manual* and the *ProTool Online Help*.
Information about STEP 7 and its option packages is provided by the relevant manuals for STEP 7, S7-PDIAG and S7-GRAPH. These programs too have extensive online Help systems.

1.2 Position within the Information Environment

There are a number of manuals and online help systems relating to ProTool and the various types of operating unit.

The diagram below illustrates the position of the ProAgent documentation within the overall documentation structure.



Position within the Information Environment

The tools for programming the PLCs under STEP 7 have their own documentation which is not included in the above diagram.

Whereas with ProTool the configuration software and devices are described separately from each other, the User's Guide and online Help for ProAgent explain both the configuration and operation on the devices.

The online Help and User's Guide are identical to a large extent. However, detailed descriptions of individual dialog box elements and a reference section of all functions and error messages are available only in the Online Help.

1.3 History

The different releases of the User's Guide describe the following software versions:

Release 06/97	ProTool 3.0 through 4.0
	ProAgent 3.0 through 4.0
Release 07/98	ProTool Version 5.0 or higher
	ProAgent Version 5.0 or higher Functional Expansions
Release 01/99	ProAgent Version 5.1 or higher Expansions for Touch Panel
Release 09/99	ProAgent Version 5.2 or higher Functional Expansions

1.4 Notation

Different character formats are used to help you find your way through the text, as follows:

`Output`	Words in "typewriter" font (Courier) represent inputs and outputs as they appear on the screen of the PC/PU or on the operating unit display.
F1	Names of keys are printed in bold type face.
System → ProAgent	Menu options are shown in italics. Successive submenus/options are separated by arrows. The complete route to the menu option in question is always shown.
Messages dialog box	Names of dialog boxes, input boxes and buttons appear in italics.

1.5 Abbreviations

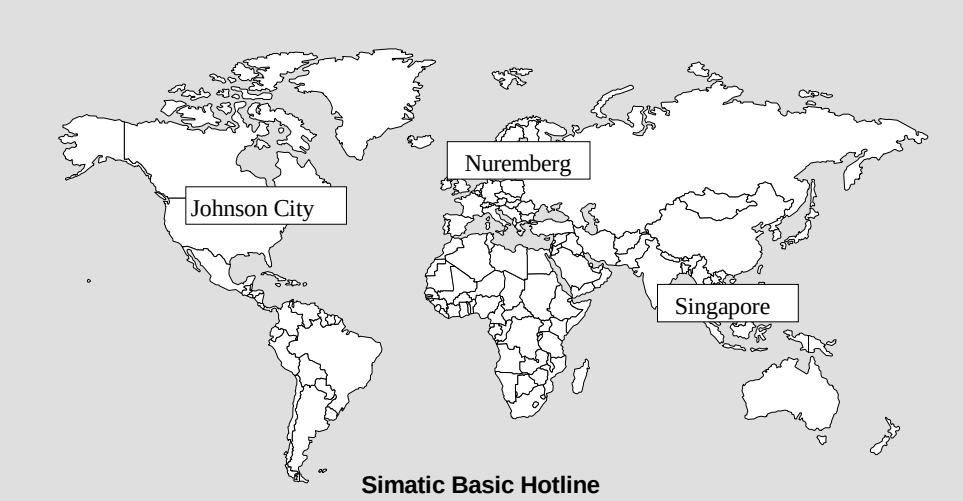
The abbreviations used in this documentation stand for the following:

AM	Alarm message
CPU	Central processing unit
DB	Data block
EM	Event message
FB	Function block
FC	Function
HMI	Human-machine interface
LAD	Ladder diagram
MPI	Multipoint interface
OB	Organization block
OP	Operator panel
PC	Personal computer
PLC	Programmable logic control
PU	Programming unit
RLO	Result of logical operation
STL	Statement list
TP	Touch panel
UDT	User-defined data type

1.6 Other Sources of Assistance

SIMATIC Customer Support Hotline

Available round the globe, 24 hours a day:



Nuremberg SIMATIC BASIC Hotline	**Johnson City SIMATIC BASIC Hotline**	**Singapore SIMATIC BASIC Hotline**
Local time: Mo-Fr 8 a.m. through 6 p.m. **Telephone**: +49 911 895-7000 **Fax**: +49 911 895-7002 **e-mail**: simatic.support@ nbgm.siemens.de	**Local time**: Mo-Fr 8 a.m. through 5 p.m. **Telephone**: +1 423 461-2522 **Fax**: +1 423 461-2231 **e-mail**: simatic.hotline@ sea.siemens.com	**Local time**: Mo-Fr 8.30 a.m. through 5.30 p.m. **Telephone**: +65 740-7000 **Fax**: +65 740-7001 **e-mail**: simatic@ singnet.com.sg
SIMATIC Premium Hotline		
(with charges, with SIMATIC Card only) **Time**: Mo-Fr 24 hours	**Telephone**: +49 911 895-7777	**Fax**: +49 911 895-7001

SIMATIC Customer Support Online Services

SIMATIC Customer Support offers you a great amount of additional information about SIMATIC products via online services:

- Up-to-date general information can be found
  - in the Internet under http://www.ad.siemens.de/simatic
  - via fax polling no. 08765–93 02 77 95 00
- The latest product information sheets and downloads that may be of practical use can be found:
  - in the Internet under http://www.ad.siemens.de/support/html-00/
  - via the Bulletin Board System (BBS) in Nuremberg (SIMATIC Customer Support Mailbox)
    under the number +49 911 895–7100.

    To call the mailbox, use a modem that complies with at least V.34 (28.8 kbaud) and whose parameters are set as follows: 8, N, 1, ANSI. Or use an ISDN card (X.75, 64 kbit).

Installation 2

Overview

This chapter explains how to install ProAgent under STEP 7 and under ProTool.

2.1 System Requirements

Hardware Requirements

The hardware requirements are the same as for the basic ProTool program.

In addition, you will also need the following:

Free hard disk space	approx. 15 MB on the drive on which ProTool is installed
PLC	SIMATIC S7 with ALARM_S-compatible CPU

Software Requirements

Microsoft Windows 95 or Windows NT 4.0	
ProTool	Version 5.0 or higher
STEP 7	Version 4.02 or higher
S7-PDIAG	Version 4.0 or higher
and/or S7-GRAPH	Version 4.0 or higher

2.2 Installing ProAgent

Integrated Installation

ProAgent requires that ProTool has been installed integral with STEP 7. At least one of the STEP 7 option packages S7-PDIAG or S7-GRAPH is also required.

If STEP 7 and S7-PDIAG or S7-GRAPH are not currently installed on your system, install those programs first before installing ProAgent.

Note
STEP 7 is the first program that has to be installed.

Installing ProAgent

To install ProAgent proceed as follows:

1. Start SETUP.EXE on the installation medium.
   A dialog box appears for entering the destination folder.
2. If you wish to install ProAgent in a folder different from the one proposed, click the *Browse* button. However, the destination folder must be a folder in which a version of ProTool meeting the above system requirements has been installed.
3. Click the *Next* button.
   Setup shows you the exact amount of space, in kilobytes, you require and how much is available on the destination drive.

   If the amount of space available on the drive you selected is insufficient, delete any programs or files you no longer require.

   Tip:
   It is frequently sufficient to empty the recycle bin to release sufficient space on the hard disk.
4. If you have sufficient space, click the *Next* button.

   All the languages you configured for ProTool are configured automatically.

Installed Files

The installation program copies the necessary program files to the folder specified.

In addition, a further folder called `PROAGENT\STANDARD` is created beneath this folder. Here you will find a STEP 7 project with the supplied standard diagnosis screens.

Symbols on the Taskbar

ProAgent does not have a program icon of its own. All ProAgent's functions are accessible only through ProTool.

Nevertheless, two new logical links are added to the Windows Start menu:

ProAgent for OP

You use this symbol to call ProTool's online documentation. It contains all the information described in the User's Guide.

ProAgent for OP Example Description

You use this symbol to open an electronic document containing a graphic introductory example. This example guides you through getting started with S7-PDIAG and ProAgent and therefore helps to get you going.

To view this example, you need the program Acrobat Reader. If the program has not yet been installed on your system, you can install it from STEP 7's Setup.

Up-to-date Information

You will find late-breaking information on ProAgent in the `Readme.txt` files. Please note all the tips mentioned in that file.

2.3 Uninstalling ProAgent

You can uninstall ProAgent in the customary manner under Windows 95 and Windows NT:

1. From the Windows Start Menu choose *Settings* → *Control Panel* → *Add/Remove Programs*
2. Choose the *Install/Uninstall* tab.
3. From the list of programs, select *SIMATIC ProAgent V5.x*.
4. Click the *Add/Remove...* button and follow the instructions on the screen.

ProAgent is then removed from your system.

Introduction

3

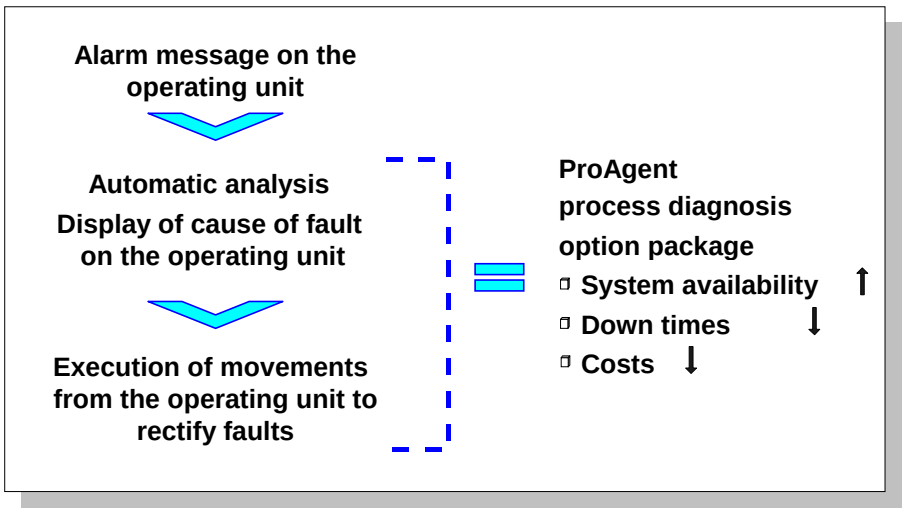
Overview

This chapter explains the benefits of process diagnosis and shows you how to locate a fault on the operating unit and rectify it. An overview shows the steps required for configuration and where the interfaces between STEP 7, ProTool and ProAgent are.

At the end of the chapter, a number of important terms that are frequently encountered in the context of process diagnosis are explained.

3.1 What Process Diagnosis Can Achieve

When you use SIMATIC S7 controllers you can configure a powerful process diagnosis system. It will help you to rapidly identify potential problems and to eliminate them. In that way, you will be able to increase the availability of your installation, reduce down times and bring down costs.



Sequence and Benefits of Process Diagnosis

Avoiding Problems

Many problems can be avoided from the outset

The flexibility of the process diagnosis system enables potential problems in the process sequence to be identified before they actually occur. A worn tool, for example, is normally signaled by an increase in the forces involved. The process diagnosis system can monitor those forces and initiate replacement of the tool at the appropriate time.

Identifying Problems

Problems can still be identified without a process diagnosis

The SIMATIC operating units allow you to visualize installations, that is, display them, and to control them with ease. A powerful message system draws your attention to process faults.

An error message appears on the operating unit as an indication.

Rectifying Problems

Situation-relevant information assists you in locating the fault

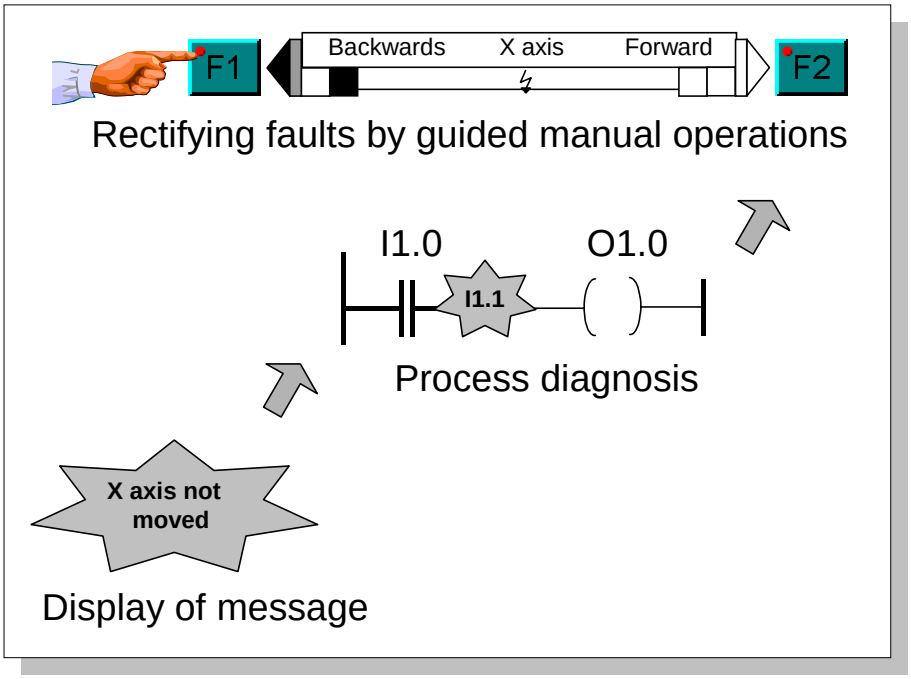
When problems occur in the process sequence, you can easily retrace the faults to the units from which they originate. To do so, you can examine on the operating unit the logical operation results in the statement list or ladder diagram. You don't have to connect up a PU. And the fault can be located just as quickly.

You can quickly remedy the problem

You can selectively initiate movements on the operating unit to remedy the problem.

If a number of installation components have been damaged, this is indicated on the operating unit and you can initiate simultaneous repair of the individual components.

And that means that your installation will be ready for operation again as quickly as possible.



Message, Diagnosis, Assistance with Fault Rectification

Reducing Costs

Early identification and elimination of faults

- increases installation availability
- reduces down times
- and thus ultimately reduces costs

3.2 How a Process Diagnosis is Carried Out

Diagnosis Screens

When the process diagnosis is configured, various additional standard diagnosis screens (diagnosis screens for short) are incorporated in the project. Those screens are linked to one another by keys. The contents of the screens automatically adapt to the technical units of the installation.

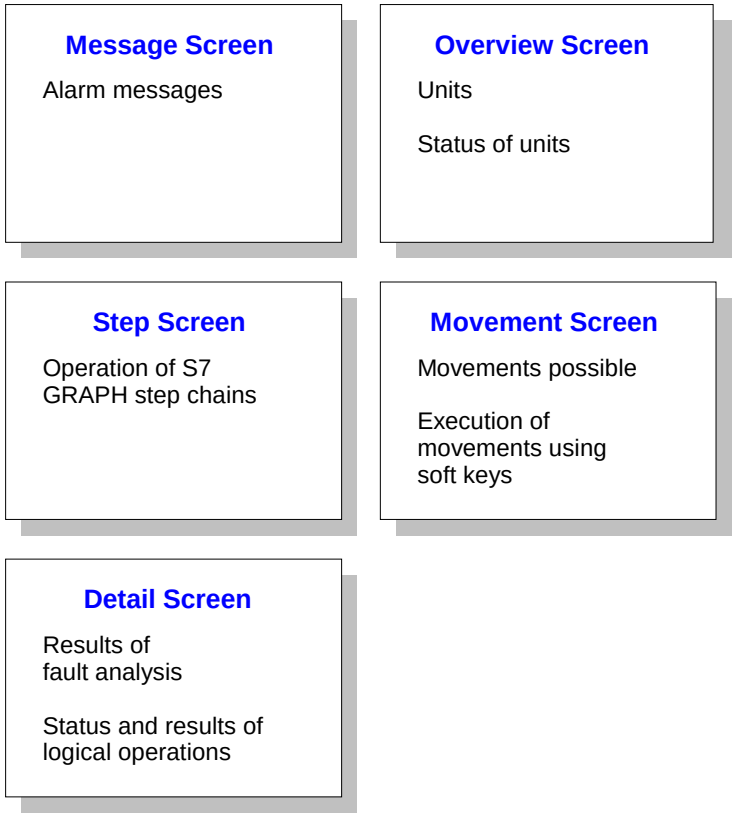
For the operator on the operating unit, process diagnosis is simple in view of these diagnosis screens:

When a fault occurs, an alarm message appears on the **Message Screen** on the operating unit.

By identifying this alarm message by an asterisk (*), the operator sees that the malfunction is "capable of being diagnosed" - in other words, it indicates that he can trace the cause of the fault on the operating unit.

At the press of a button, the operator can switch either to an overview screen, a step screen, a movement screen or a detail screen.

- On the **Overview Screen**, all the units of the system are displayed together with their subunits. This shows the operator at a glance the current operating mode and condition of each individual unit.
- In the case of units programmed with S7-GRAPH, individual steps of a chain can be set or reset by selecting an additional **Step Screen**.
- The **Movement Screen** provides quick assistance with rectifying faults. By looking at the display, the operator can tell at a glance which movements are blocked and which can still be executed. It can be used to initiate movements by individual units by means of keys.
- The **Detail Screen** shows the results of the fault analysis automatically instigated from the operating unit. A brief signal list, a detailed instruction list (STL) or a ladder diagram (LAD) showing the relevant section of the STEP 7 program code appears on the display for that purpose. At the same time, the status bits of the operands and all the logic operation results can be displayed. Signals that have caused a fault are highlighted. You can quickly trace the cause of an error in this manner.



The Different Diagnosis Screens

Standardization

The user interface on the operating unit is standardized so that operation follows a uniform pattern for all installations and components.

A detailed description of the individual diagnosis screens is given in the chapter *Display on the Operating Unit (Chapter 5).*

3.3 How a Process Diagnosis is Configured

System Concept

ProAgent is a universal system concept and designed for optimum interaction between STEP 7, STEP 7 option packages and the operating unit configuration program, ProTool.

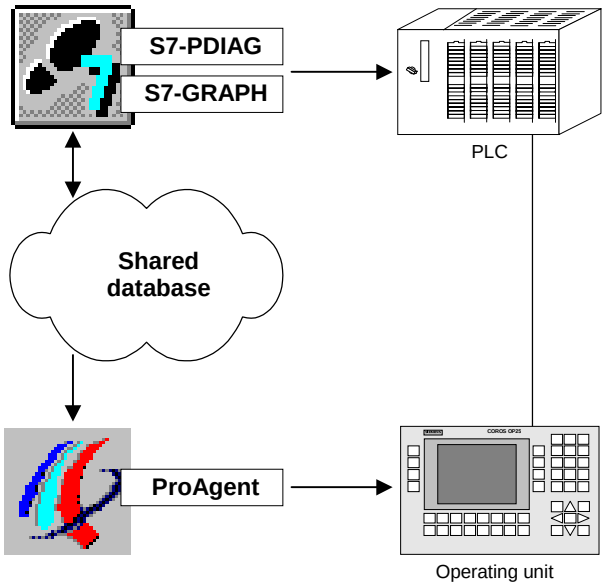
Configuring the process diagnosis in ProTool is quick and simple to perform. And the same is true whether you are incorporating process diagnosis in a new or an existing PLC program.

Subtasks

Just as when configuring an installation, there are two main subtasks involved in implementing a process diagnosis:

1. programming the PLC
2. configuring the operating unit

ProAgent, like ProTool, is used for the second step only, i.e. configuring the operating units.



Stages Involved in Configuring the Process Diagnosis

Programming the PLC

Depending on the programming language you are using for the PLC, the preparations for the process diagnosis will differ as follows:

- If you are using S7-GRAPH, your programs will automatically be capable of diagnosis.
- If you are programming in LAD/CSF/STL, you need the S7-PDIAG option package. S7-PDIAG creates additional blocks for monitoring your process for the purposes of fault detection. This is mostly done automatically.

Thanks to the global nature of S7 process diagnosis, you can also work with different programming languages within the same system – entirely as circumstances demand. You can also detect and locate process faults in "mixed" sequential and logic control systems.

Programming the PLC and defining the settings in S7-PDIAG are the first steps in creating the process diagnosis. That is followed by configuration of the operating units using ProTool and ProAgent.

Common Database as Interface

When translating the PLC program, the STEP 7 option packages store all the data required for the process diagnosis in a shared database.

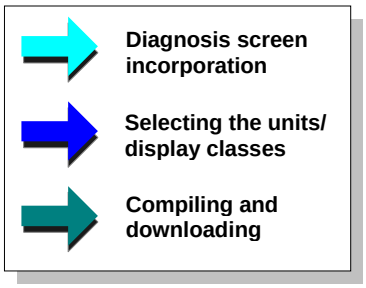
ProTool then accesses that database when the operating unit is configured during the next stage.

Configuring the operating unit

Once the STEP 7 program has been created, the process diagnosis can be configured for the operating unit. It is only at this stage that the ProTool option package ProAgent comes into play.

It goes without saying that you do not need to repeat any of the entries already made in STEP 7. All relevant information has been stored in the shared database that ProTool now accesses.

This is what makes the process of configuration in ProTool so quick and easy to complete. All you have to do is



Configuring the Operating Unit for Process Diagnosis

The first step involves adopting the standard diagnosis screens supplied with ProAgent.

The screens are now fully ready. If, in certain situations, you should nevertheless wish to modify any of the screens to suit your own particular requirements, that presents no problem.

Next, you select the units of your S7 PLC for which you wish to set up a process diagnosis. Making that selection is simple: ProTool compiles a list from the shared database and all you need to do is click the relevant units.

You can also specify which messages are to be displayed on the operating unit. Selection is made by display class which, once again, you simply select from a list.

By judicious selection you can restrict the range of messages displayed on the operating unit. The remaining messages could then be output to another operating unit or control desk, for example.

Conclusion

As you can see, configuring a process diagnosis is not all complicated. Thanks to the seamless integration of ProTool and ProAgent with the relevant STEP 7 option packages, it need take only a few minutes. If you should have very particular requirements in certain cases, the open architecture allows you to easily adapt the functions to meet special demands.

3.4 Before You Start

In order to be able to configure a process diagnosis, certain basic requirements must be met. They can be summarized as follows:

- ProTool must be installed integral with STEP 7.
- ProAgent must be installed.
- The PLC must already be programmed with LAD/CSF/STL and S7-PDIAG or with S7-GRAPH (both S7-PDIAG and S7-GRAPH can be used for a PLC).
- If the PLC has been programmed in LAD/FUP/STL, additional error detection blocks must have been created using the option package S7-PDIAG. Error detection must have been activated.
- The PLC program must have already been compiled.

3.5 Important Terms

Units

In S7-PDIAG, a unit is a block, in S7-GRAPH it is a sequence of steps.

Units are objects of the process diagnosis that are monitored with the aid of error definitions. There can be several error definitions for each unit. Units can be physical objects in the process (e.g. a press or die) which in turn can incorporate movements (e.g. forward/backwards, up/down).

Units are logical hierarchical criteria and structure the view of the process They may store data that is shared by all hierarchically subordinate objects. Hierarchically subordinate objects can in turn be other units or movements, for example.

Each unit can incorporate one or more actions.

Actions

Actions are components of a unit. Their purpose within the process is to control a single actuator.

In program terms, an action is

- a network in a LAD/CSF/STL program
- a step in a S7-GRAPH program

Transitions

A transition describes a condition for progressing from one step to the next within a sequence of steps.

Transitions exist only in S7-GRAPH.

Movements

Movements relate to sequences in the process that can be monitored with the aid of error definitions in the process diagnosis. There can be several error definitions for each movement. A movement can be contained within a unit and represents an actual movement on the part of a physical object within the process (e.g. a die moves up and down).

Movements are defined in S7-PDIAG by using the UDT "Movement" within a block.

Effects on ProTool

4

Overview

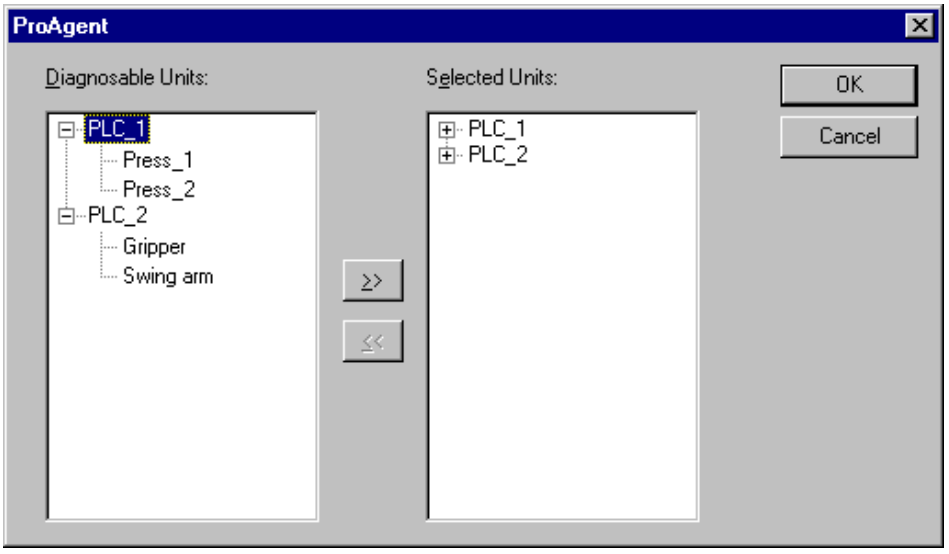
Installing the ProAgent option package adds a number of new menu options and functions to the basic ProTool program. This chapter shows you what those new menu options and functions are and what their purpose is.

4.1 Additional Menu Options in ProTool

Installing ProAgent changes very little on the ProTool user interface.

System → ProAgent

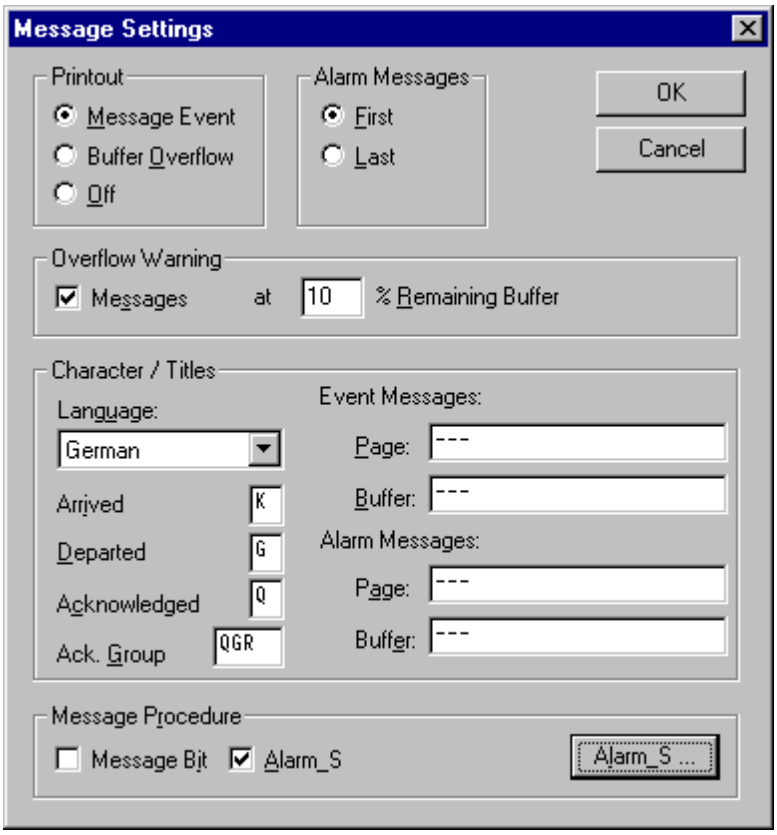
The *System* menu now includes the item *ProAgent*. By choosing this option you can select the ones for which you wish to configure the diagnosis from the units of your system. The messages that belong to these units will then be shown at the operating unit.



Selecting units by choosing System → ProAgent

System → Messages → Settings

By selecting the menu item *System → Messages → Settings*, you open the ProTool dialog box *Message Settings*.



Messages Dialog Box with New *Message Procedure* Section

Installing ProAgent/Pro adds a new section entitled *Message Procedure* to this dialog box. This is where you specify the *ALARM_S Message Procedure (Chapter 4.4)* required for diagnosis. You can also restrict the display to messages of specific display classes.

4.2 Additional Functions in ProTool

There is a number of additional functions available in ProTool for process diagnosis after ProAgent has been installed.

These additional functions all begin with ProAgent". They are used on the Diagnosis Screens that are added when ProAgent is installed.

These functions are not required unless you change the diagnosis screens or use individual diagnosis elements in your own screens.

Details of how to modify the diagnosis screens and what you should bear in mind when doing so are explained in the chapter *Modifying the Diagnosis Screens (Chapter 8)*.

A detailed description of all functions is provided in the ProAgent Online Help under the heading "Functions (Overview)".

4.3 Additional Standard Screens (Diagnosis Screens)

When ProAgent is installed, an additional STEP 7 project called `ProAgent` is created. That project contains standard screens for the individual diagnosis tasks. In order to distinguish them from the conventional standard screens, they are referred to as **diagnosis screens**.

How to incorporate the diagnosis screens in your own projects and link them to other screens is explained in the chapter *Incorporating the Diagnosis Screens (Chapter 6.1.4)*.

A detailed description of the individual screens is given in the chapter *Display on the Operating Unit (Chapter 5)*.

In general, it is not necessary to alter the diagnosis screens. Nevertheless, they can be adapted to individual circumstances if necessary and how this is done is explained in the chapter *Modifying the Diagnosis Screens (Chapter 8).*

4.4 ALARM_S Message Procedure

Why ALARM_S?

The STEP 7 option packages S7-PDIAG, S7-GRAPH and S7-HiGraph only issue ALARM_S messages. These ALARM_S messages are accessed during configuration of a process diagnosis.

Installing ProAgent/Pro automatically activates the ALARM_S message procedure in ProTool.

You can use ALARM_S in parallel with the previously used message bit procedure, e.g. to continue using existing projects. In this case, you must also activate this message procedure in the *Message Settings* dialog box, which can be opened with the menu item *Target System* → *Messages* → *Settings*.

What is ALARM_S?

ALARM_S is a message number procedure. The message numbers are issued automatically during the configuration process in STEP 7. The numbers are used as the basis for assignment of the correct message text.

The individual messages can be assigned different display classes. When configuring, you then can then choose a specific selection of display classes for an operating unit. In that way you can distribute the messages selectively between display units.

When a fault occurs, the CPU transmits not only the status of the message (arrived, departed, acknowledged) but also the time.

Changes as a Result of ALARM_S

Using the ALARM_S message number procedure initiates the following changes:

- The messages are no longer configured in ProTool but beforehand when programming the PLC in STEP 7. You also assign a display class to each message at that point.
- The message screen display marks diagnosable messages by an asterisk * before the message number.

Other Sources of Information

More information on the subject of message processing and ALARM_S is available in the chapter *Message Processing (Chapter 7)*.

You can find a description of the procedure to be followed during configuration in the chapter *Selecting the Display Classes (Chapter 6.1.7)*.

Display on the Operating Unit

5

Overview

This chapters shows you in detail how the individual diagnosis screens appear on the operating unit, what they contain and what functions you can activate.

5.1 Overview of the Diagnosis Screens

5.1.1 How to Activate Diagnosis

Diagnosable Messages

You are already familiar from ProTool with the options available for working with message lines and message windows: depending on the operating unit and configuration, alarm messages are either displayed in a message line or in an alarm message window.

The message line and alarm messages window are still used – even if a process diagnosis has been configured using ProTool and ProAgent. However, diagnosable messages are now identified by an asterisk * in front of the message number.

You can only carry out a diagnosis for that type of message.

```
*1234567 A KGQ HH:MM:SS DD.MM.YYYY GRU00
     Boiler 13: temperature 190 degrees
     Inform shift supervisor Tel. 007
```

Structure of an Alarm Message

Diagnosis Start Screen

The way in which you start the diagnosis depends on the Project concerned. In the simplest case, there is a key that is used to activate the diagnosis start screen. From there you can then move to other diagnosis screens as required.

Other Routes

Your project may also provide specific keys for moving directly to individual diagnosis screens.

You then start the diagnosis from those screens, bypassing the diagnosis start screen.

Message Acknowledgement

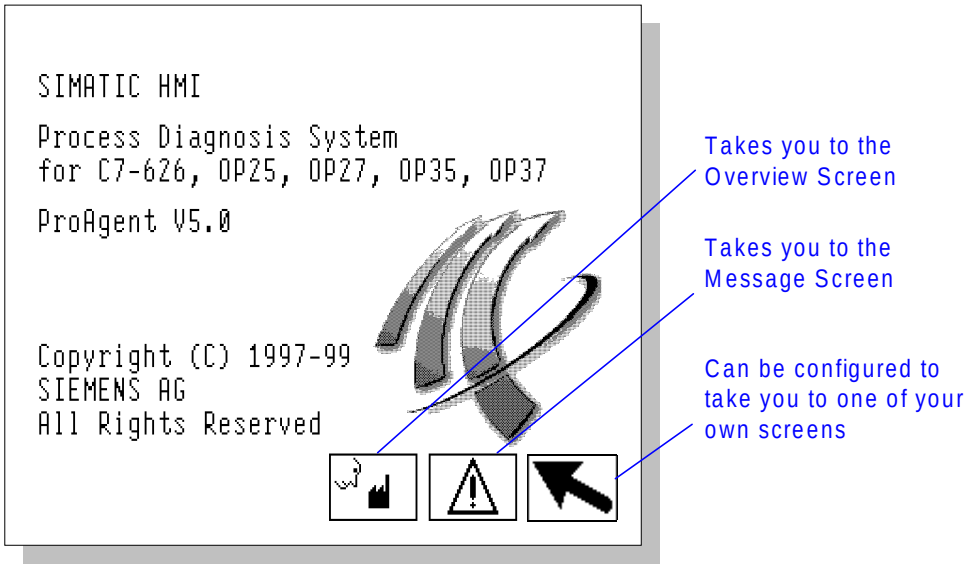
On completion of the diagnosis and rectification of the fault, you must acknowledge the message by pressing the ACK key as normal. If the alarm message belongs to an acknowledgement group, when it is acknowledged, all other alarm messages in that group are acknowledged at the same time, as normal.

5.1.2 The Purpose of the Individual Diagnosis Screens

If you have read the preceding chapters you will be aware from the Introduction that when a process diagnosis is configured, a number of additional standard diagnosis screens are incorporated. The process diagnosis is performed from those screens.

All diagnosis screens are standardized to a large degree and differ in only minor details from one operating unit to another. The illustrations below show examples of diagnosis screens as they appear on an OP25.

Diagnosis Start Screen

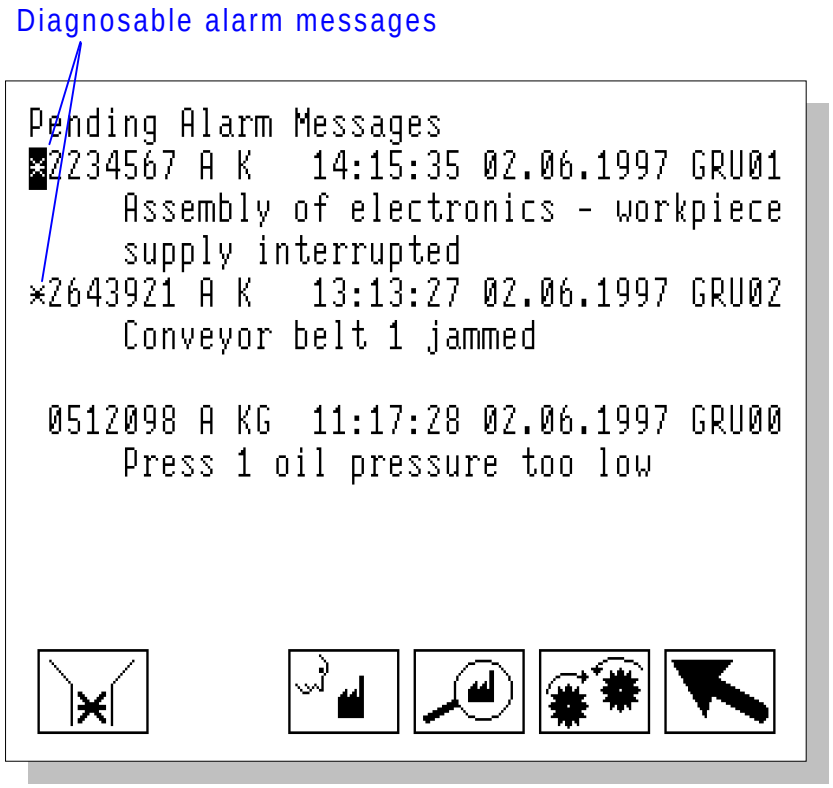


Diagnosis Start Screen (As Shown on OP25)

The Diagnosis Start Screen forms the point of entry and distribution for the diagnostic functions. From there, you can move to the Message Screen and the Overview Screen where you can obtain an initial overview of pending error messages.

Whether or not the Diagnosis Start Screen is actually used depends on the particular configuration concerned.

Message Screen



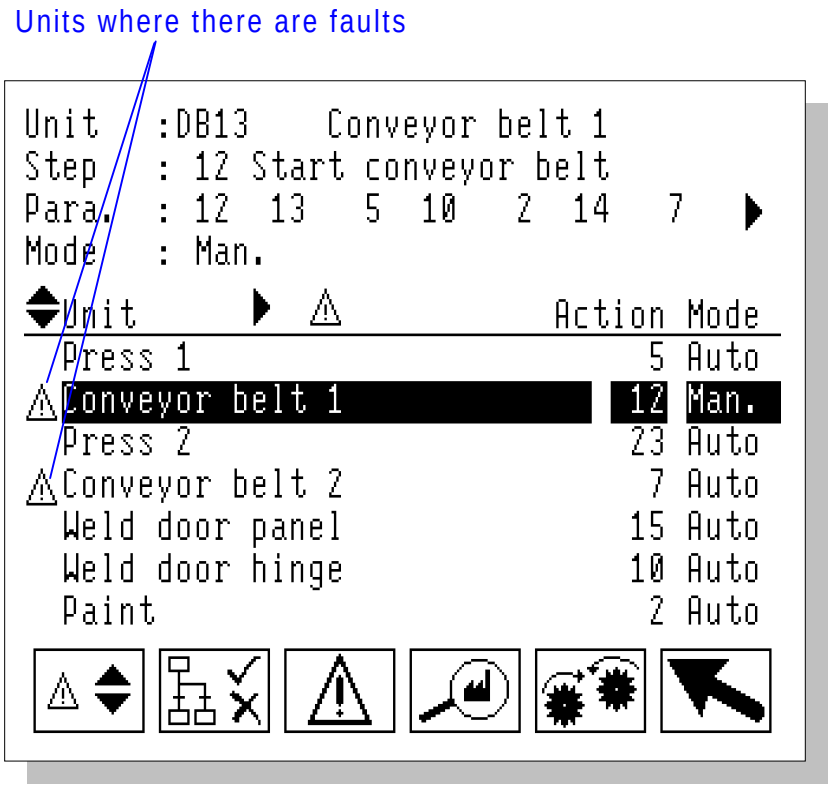
Message Screen (As Shown on OP25)

Like the Diagnosis Start Screen, the Message Screen also often serves as the point of entry into the diagnosis. Its structure is similar to that of a conventional alarm message window except that additional keys are provided for selecting other diagnosis screens.

Diagnosable messages are identified by an asterisk * in front of the message number. You can only carry out a diagnosis for that type of message.

A detailed description of the Message Screen is given in the chapter *Message Screen (Chapter 5.2)*.

Overview Screen



Overview Screen (As Shown on OP25)

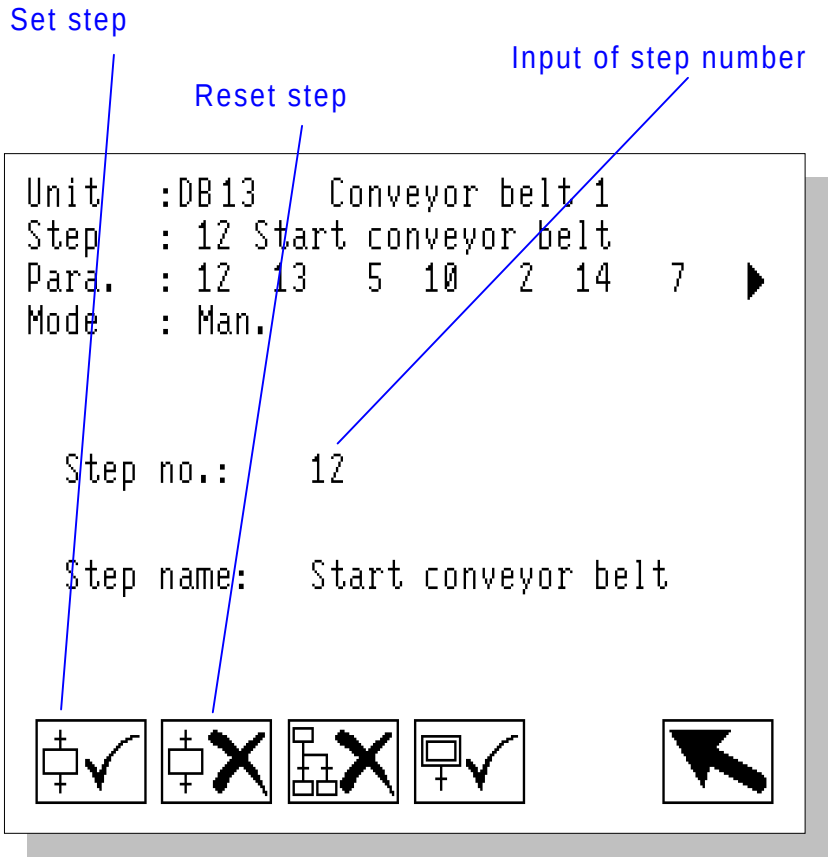
The Overview Screen shows all the units present in your system.

This shows you at a glance the current operating mode and condition of each individual unit. Blocked units are identified as such. Once a fault has been rectified, the marker disappears again.

A detailed description of the Overview Screen is given in the chapter *Overview Screen (Chapter 5.3)*.

If your system contains units programmed with S7-GRAPH, you can use a slightly modified overview screen as an alternative (refer to *Alternative Overview Screen for S7-GRAPH (Chapter 5.3.7)*).

Step Screen

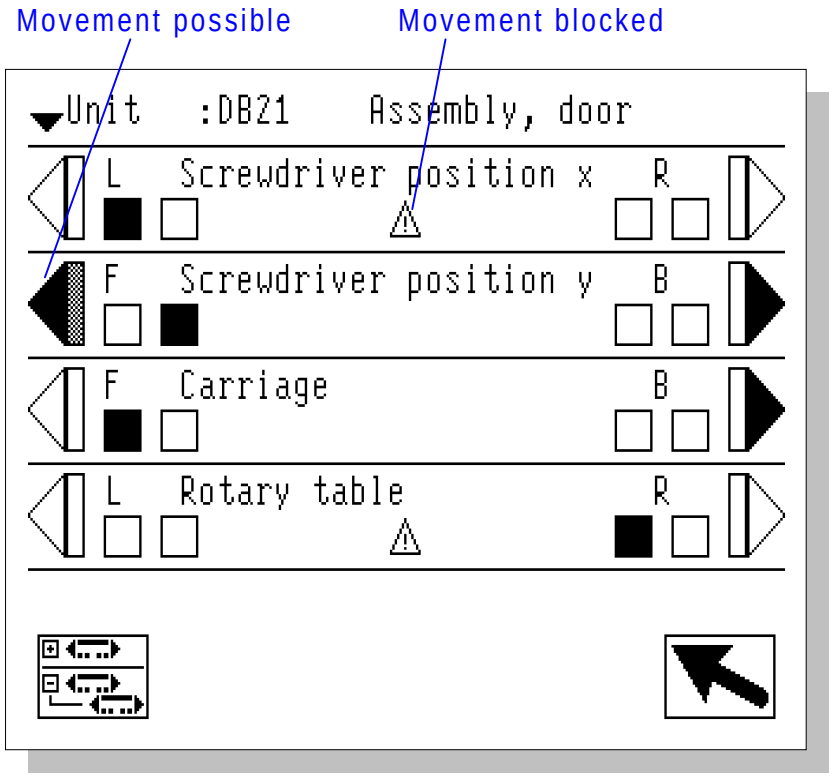


Step Screen (As Shown on OP25)

If your system has units that were programmed in S7-GRAPH, you can operate a S7-GRAPH sequencer on the step screen. You can set or reset every step in the sequencer.

A detailed description of the step screen is given in the chapter *Step Screen (Chapter 5.4)*.

Movement Screen



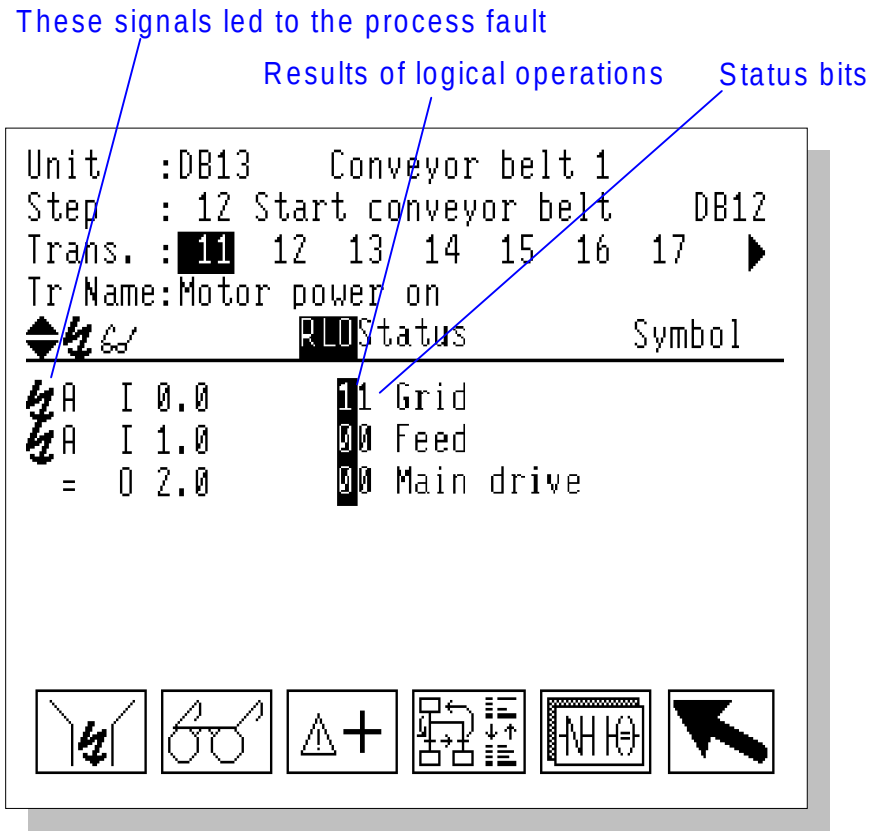
Movement Screen (As Shown on OP25)

The Movement Screen provides assistance with rectifying faults. You can use the keys at the sides to initiate specific movements on individual units.

The symbols displayed help you to see at a glance whether a movement is blocked.

A detailed description of the Movement Screen is given in the chapter *Movement Screen (Chapter 5.5)*.

Detail Screen



Detail Screen (STL Format As Shown on OP25)

The process diagnosis analyzes which signals in the PLC program have led to an error message. The Detail Screen shows the results of that analysis. This means that you can not only see that a fault has occurred, you are immediately shown what has caused it as well.

The detail screen displays the corresponding section of the STEP 7 program code in signal list, in STL or LAD format. At the same time, the status bits of the operands and all logical operation results are also detailed. Signals that have caused a fault are highlighted.

A detailed description of the Detail Screen is given in the chapter *Detail Screen (Chapter 5.6)*.

5.1.3 How the Diagnosis Screens are Linked to One Another

Five Diagnosis Screens

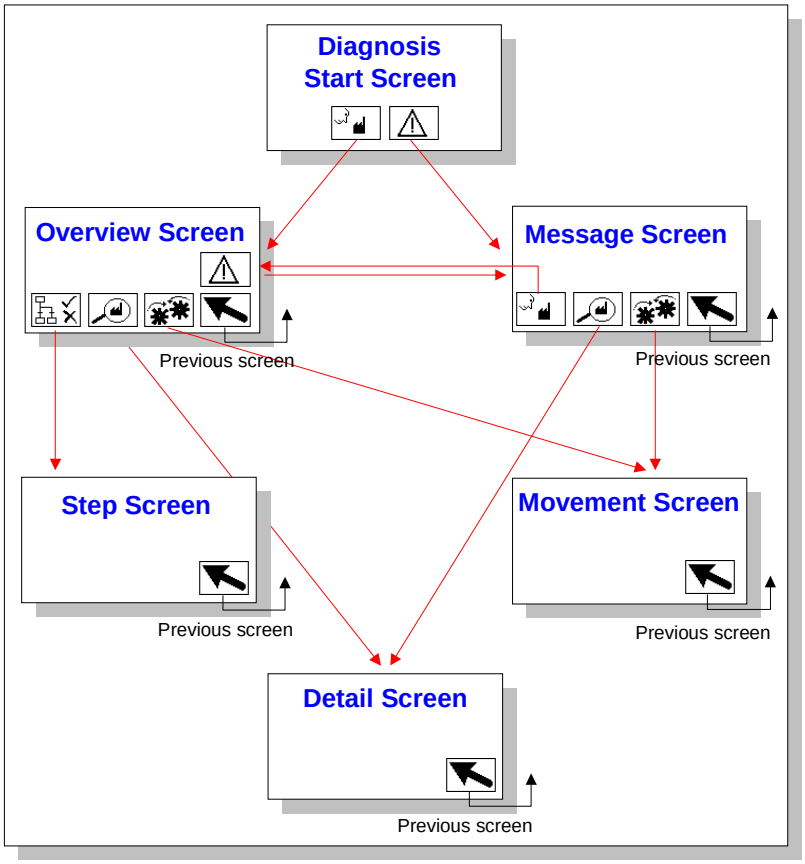
The five diagnosis screens - Message Screen, Overview Screen, Detail Screen, Movement Screen and Step Screen - are linked by means of keys so that you can switch to and fro between the different screens.

One Diagnosis Start Screen

There is also a Diagnosis Start Screen that often serves as the point of entry to the diagnosis functions (see *How to Activate Diagnosis (Chapter 5.1.1)*).

Links

The diagram below shows the ways in which you can navigate between the screens:



Possible Navigation Routes Between the Diagnosis Screens

The point of entry to the diagnosis is normally provided by the Diagnosis Start Screen, the Message Screen or the Overview Screen. You can access any of the other diagnosis screens from the Message Screen and the Overview Screen.

Your particular configuration may differ from this arrangement of links. If your project provides the means, you may also be able to move directly to specific diagnosis screens from other system screens.

The Previous Screen key will then take you back to that system screen.

5.1.4 General Principles of Using the Diagnosis Screens

Standardization

The way in which the diagnosis screens are used is not significantly different from the way in which the other screens are used. Likewise, the appearance of diagnosis screens differs only minimally for different types of operating unit (e.g. OP and TP). For this reason, we will always refer to control elements that are activated on an OP by means of a softkey or function key and on a TP by means of a key-shaped button by the generic term "keys".

There are however a number of peculiarities that depend on whether you are using a key-controlled operator panel (OP) or a touch panel (TP). These peculiarities are summarized below.

There are various symbols used on the diagnosis screens. Once you are familiar with them, you will find your way around all the diagnosis screens very easily.

Cursor Control on the OP

On the diagnosis screens, the cursor keys are not used to move between input fields, as is normally the case, but to scroll the list displayed.

These symbols are displayed if there are more lines than can be shown on the operating unit at one time. You then have to scroll the screen to see the remaining lines.

You always use these keys to scroll up or down.

What's more, the cursor keys have the following functions in the individual diagnosis screens:

▲ ▼	In the Message Screen, you use the cursor keys to move the cursor up and down. If there are more messages than can be shown on the screen, the display is scrolled as soon as you move the cursor beyond the top or bottom of the screen.
▲ ▼	In the Overview Screen you use these cursor keys to move the cursor between the individual units. If there are more units than can be shown on the screen at a time, once again the display is scrolled as soon as the cursor is moved beyond the top or bottom of the screen.
◀ ▶	You use these cursor to switch between hierarchical units in the Overview Screen.
◀ ▶ ◀▶	If this is possible, these symbols are displayed on the operating unit.
▲ ▼	If there are more lines on the Detail Screen (STL) than can be displayed at once on the operating unit, you use these cursor keys to scroll a complete page up or down.
◀ ▶	If you are viewing the screen in an LAD, you can use these cursor keys to scroll horizontally.
▼ ▲	If there are more possible movements than can be shown on the Movement Screen at once, you can similarly use these keys to scroll up or down a complete page at a time.

Cursor Function in the Individual Diagnosis Screens

Toggling Cursor Control (OP only)

You can use the Change Windows key to toggle between the special diagnosis screen cursor control features and the standard cursor control. If the Message Window or the Fixed Window are open, you can also switch to those windows. In that case the sequence is as follows:

Diagnosis cursor – normal cursor – Message Window – Fixed Window – Diagnosis cursor ...

Peculiarities of a Touch Panel

When you use a touch panel, you select individual elements of the diagnosis screens by touching the corresponding location on the screen. Selected elements are then inverted. At locations on the screen at which it is not possible to invert the display of such elements, a hand appears on the screen indicating that a touch function has been activated.

If there are more lines than can be shown on the screen of the operating unit at one time, you can scroll the display of the TP.

- To scroll up, touch the top most entry in the scrollable area of the screen until scrolling is activated.
- To scroll down, touch one of the other entries until scrolling is activated.

The length of time you have to keep touching the screen until scrolling is activated depends on the repeat time set (menu item: *System* → *Functions* → *Initialization* → *Functions*).

What's more, the following peculiarities apply to the different diagnosis screens:

- In the Overview Screen, you can use these keys to switch between hierarchical units.

- In the Detail Screen LAD, you scroll by touching the outermost switch in the scroll direction until scrolling is activated.

Common Symbols

Irrespective of the operating unit you are using, various graphical symbols are displayed on the screen.

You have already come across two graphical symbols in connection with cursor control:

	Indicates that you can scroll vertically.
	Indicates that you can scroll horizontally or that hierarchically subordinate/superior units can be displayed.

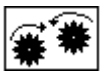
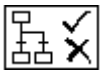
Indication of Cursor Function

Other symbols are used to identify units where there are faults and incorrect logical operation results as follows:

⚠	Identifies a blocked movement or a faulty unit. The unit whose fault occurred first chronologically is identified by a flashing symbol.
	Denotes a failed operand.

Indication of Faults

Pictograms identify the keys for selecting diagnosis screens as follows:

	Symbolizes the Message Screen.
	Symbolizes the Overview Screen.
	Symbolizes the Detail Screen.
	Symbolizes the Movement Screen.
	Symbolizes the Step Screen.

Keys for Selecting Diagnosis Screens

5.2 Message Screen

5.2.1 The Purpose of the Message Screen

The Message Screen shows all pending process messages. The messages are listed on the screen in chronological order.

The Message Screen often serves as the point of entry to the diagnosis. On it, you can observe whether faults occur and which faults those are and you can then switch to any of the other diagnosis screens as required.

Additional Functions Compared to the Message Page

The Message Screen is structured in a very similar way to a normal message page. However, it provides some additional information and functions.

For example, you can see at a glance which messages are "diagnosable". You can then carry out a process diagnosis for those messages.

You can select a specific message and use keys to call up other context-sensitive diagnosis screens such as:

- The Detail Screen, which shows the program code the monitoring of which led to the alarm message selected.
- The Movement Screen, which shows all movements for the unit with the fault. And, of course, you can also execute those movements directly from that point as well.

If you want to see an overview of the various different units of your system, you can call up the Overview Screen.

5.2.2 What You See on the Message Screen

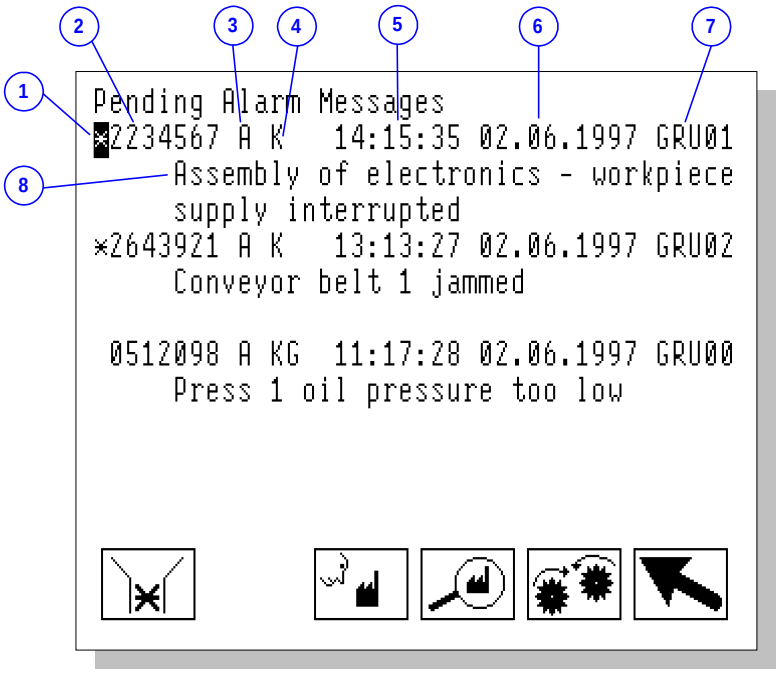
Familiar Layout

Basically, the layout of the Message Screen is the same as the normal message pages you are familiar with from the standard functionality.

Additional Functions

Compared with the normal way in which messages are displayed, however, there are a few minor changes (see *Changes in the Display of Messages (Chapter B)*).

The important feature is the identification of diagnosable messages by means of an asterisk "*" at the beginning.



Message Screen (As Shown on OP25)

(1) An asterisk appears here if the message displayed is diagnosable, i.e. if a process diagnosis can be carried out for that message. You can only call up the Detail Screen or the Movement Screen.

(2) The message number is shown here in the normal way. However, it is three digits longer than the numbers you are familiar with from previous projects.

(3) If the message concerned is an ALARM_S message (only this type of message is diagnosable), the message number is followed by the letter A.

The remaining text is arranged in the way you are familiar with from a standard message page, i.e.:

(4) Message status (arrived, departed, acknowledged)

(5) Time of arrival event

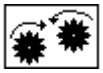
(6) Date of arrival event

(7) Acknowledgement group

(8) Message text

5.2.3 Message Screen Keys

You can use the following keys on the Message Screen:

▲ ▼	On an OP, you use the cursor keys to move the cursor up and down. On a TP, you can select a message by touching it on the screen. If there are more messages than can be shown on the screen at the one time, you can scroll the display.
	You use this key to specify whether all messages are to be displayed or diagnosable messages only (see *Selecting by Diagnosability (Chapter 5.2.5)*).
	You use this key to switch to the Overview Screen.
	Use this key to switch to the Detail Screen in Signal List format. You must have selected a diagnosable message first.
	You use this key to switch to the Movement Screen. You must have selected a diagnosable message first.
	You use this key to return to the Diagnosis Start Screen.

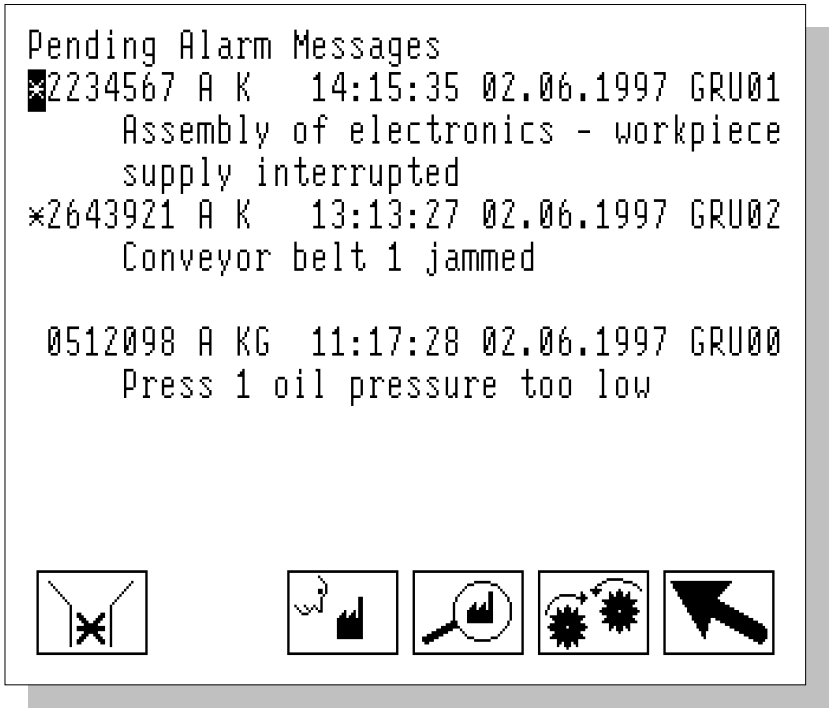
Message Screen Keys

5.2.4 How to Work with the Message Screen

This chapter gives a general outline of how to use the Message Screen in practice.

Aims

You have opened the Message Screen in order to obtain an overview of the pending alarm messages. You wish to carry out a process diagnosis for specific messages.



Message Screen (As Shown on OP25)

Filtering Out Messages

Select this key in order to gain an overview of all diagnosable messages first of all. This hides all messages that are not diagnosable.

Selecting a Message

Before you can perform a process diagnosis for a specific message, you first have to select that message. To do so on an OP, you use the cursor keys to move the cursor to the message concerned. On the TP, all you have to do is touch the desired message on the screen.

Switching to the Overview Screen

To obtain an overview of which units of your system are affected by the faults, use this key to switch to the Overview Screen. From there, you can subsequently move on to the Movement Screen in order to manually execute individual Movements for a specific unit.

Switching to the Detail Screen

Once you have selected the required message, you can use this key to switch to the Detail Screen. This shows you the section of the STEP 7 program code responsible for triggering the alarm message.

Switching to the Movement Screen

Once you have selected a message, you can use this key to switch directly to the Movement Screen (i.e. without having to go via the Overview Screen). The Movement Screen shows all movements for the units where there are faults and allows you to execute those movements directly as well.

Exiting the Message Screen

You use this key to return to the Diagnosis Start Screen.

5.2.5 Selecting by Diagnosability

On the Message Screen, you can use a key to toggle between display of all messages and display of diagnosable messages only. Displaying only diagnosable messages improves clarity for the purposes of process diagnosis.

To toggle between the two display modes, use this key.

Diagnosable messages are identified by an asterisk "*" in front of the message number.

5.3 Overview Screen

5.3.1 The Purpose of the Overview Screen

Display

The Overview Screen shows all the diagnosable units in your system.

It gives you the following information about each unit:

- whether it has a fault
- when appropriately programmed in S7–PDIAG: in what operating mode you are (e. g. manual or automatic mode)

If there are faults on more than one unit, you can see on which one the fault first occurred. In that way, you can tell immediately where the actual cause lies and which faults are consequential errors.

Functions

You can select a unit from the list and when appropriately programmed in S7–PDIAG set its operating mode. For example, you can switch from Automatic to Manual mode in order to be able to rectify a fault manually.

Once you have selected a unit, you can analyze it in more detail on the Detail Screen and then switch to the Movement Screen to execute individual movements manually in order to rectify the fault.

A description of the Detail Screen is given in the chapter *Detail Screen (Chapter 5.6)*. A description of the Movement Screen is given in the chapter *Movement Screen (Chapter 5.5)*

Alternative Overview Screen for S7-GRAPH

If your system has units programmed in S7-GRAPH, your project can use a slightly modified version of the standard overview screen in which you can see the step name as well.

Operation is largely the same as with the standard overview screen, which is described in the sections that follow.

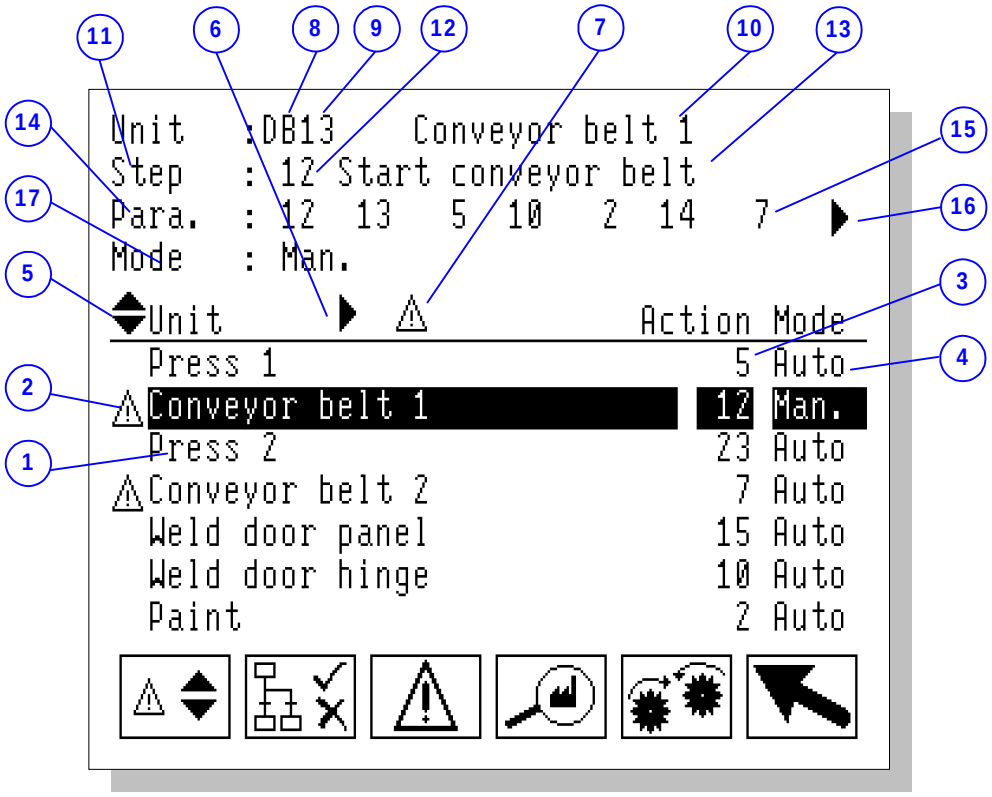
A summary of differing special features will be found in the chapter called *Alternative Overview Screen for S7-GRAPH (Chapter 5.3.7)*.

5.3.2 What You See on the Overview Screen

General Layout

Like all the diagnosis screens, the Overview Screen has a standardized layout. There are only minor differences between the various types of operating units.

The illustration below shows an example of the Standard Overview Screen as it appears on an OP25.



Overview Screen (As Shown on OP25)

Note that no display appears in fields (12) through (17) if the selected unit was programmed with **S7-PDIAG**.

Overview of Units

The center section of the display shows a list of all diagnosable units in your system. Their order of display corresponds to the sequence of screen numbers and position numbers which can be assigned as attributes when you program the units in S7-PDIAG. If no default values are specified at that stage, or if individual positions are assigned twice over (including on several CPUs), the order is arbitrary.

(1) This field displays the name of a unit from the PLC program: as the symbol for a block or as an absolute name.

(2) The warning triangle indicates that a unit has a fault. The unit on which the fault occurred first is identified by a flashing warning triangle. This tells you that the fault in question was not a consequential error.

(3) The content of this field depends on how the unit has been programmed:

- if programmed in **S7–PDIAG** a value of zero is displayed
- if programmed in **S7–GRAPH** the active step number is displayed

(4) This shows the current operating mode of the unit in question. You can change the operating mode in Field (11). If no operating mode is defined in the STEP 7 program or the operating mode display is hidden, the field (4) remains empty. An operating mode cannot be set in this case.

(5) If there are more units than can be displayed in the list at one time, the *arrow down* and *arrow up* symbols appear. In that case, you can then scroll the list up or down.

(6) If hierarchically lower-order or high-order units exist for the unit selected, the *arrow right* and *arrow left* symbols appear. In that case, you can switch to another hierarchical level (see *Hierarchical Units on the Overview Screen (Chapter 5.3.6)*).

(7) A warning triangle appears here if the display mode selected is such that the cursor moves directly from one unit with a fault to the next unit with a fault. Units without faults are displayed but can not be selected (see *Changing the Display Mode (Chapter 5.3.5)*).

Information on the Selected Unit

The top section of the display shows detailed information relating to the unit selected by the cursor.

(8) This shows the block type of the selected unit, i.e. FC, DB or OB.

(9) This field shows the block number of the selected unit.

(10) At this point text assigned to the unit appears: the symbol for a block or an absolute identifier.

(11) Here you can specify the operating mode of the selected unit. The operating modes that are possible depend on how the unit has been programmed. If the STEP 7 program does not define an operating mode, the field remains blank.

Fields (12) through (17) only appear if the selected unit has been programmed in S7–GRAPH.

(12) This field displays the text `Step`.

(13) This field displays the user number of the active step. If several actions are active at the same time, the step number of the action that appears first on the list at (15) is shown.

(14) This field displays the step name.

(15) This field displays the text `paral` to identify the subsequent numbers as parallel steps.

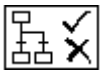
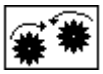
(16) These fields display the numbers of the active actions. The numbers of the actions with faults always appear first reading from left to right. Actions with faults are shown flashing.

(17) The *arrow right* symbol appears here if there are more parallel actions than can be shown at (16) at once.

5.3.3 Overview Screen Keys

You can use the following keys on the Overview Screen:

▲ ▼	On an OP, you use these cursor keys to move the cursor between units. On a TP, you can select a message by touching it on the screen. If there are more messages than can be shown on the screen at the one time, you can scroll the display.
◀ ▶	On an OP, you use these keys to switch between hierarchical units.
◀ ▶ ◀ ▶	You can tell whether subordinate or superior units are present by means of these symbols.
◀ ▶	On a TP, you use these keys to switch between hierarchical units. The corresponding key is only displayed if subordinate or superior units are present.
ENTER	On an OP, you use the ENTER key to open the text or graphic list for selecting the operating mode. On a TP, simply touch the operating mode on the screen to open a selection window that contains the associated text or graphic list.
⚠ ▲▼	This key is used to change the Display Mode. This determines whether the cursor moves through all units or only between units with faults.

	This key is used to switch to the Step Screen.
	This key is used to switch to the Message Screen.
	This key is used to switch to the Detail Screen. You must first have selected a faulty unit.
	You use this key to switch to the Movement Screen.
	You use this key to return to the Diagnosis Start Screen.

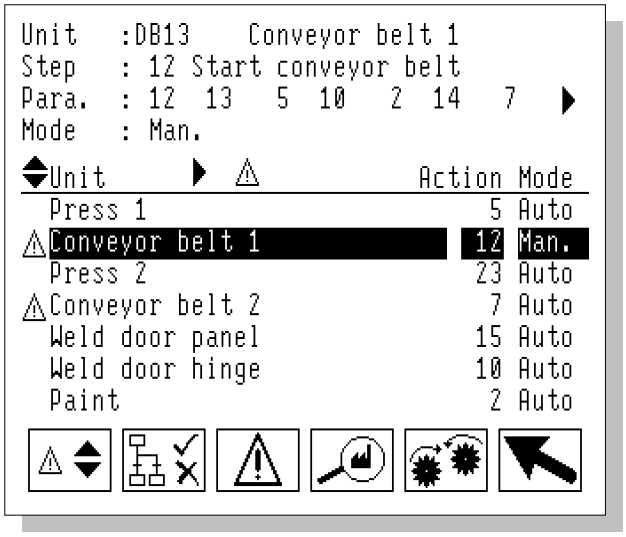
Overview Screen Keys

5.3.4 How to Work with the Overview Screen

This chapter gives a general outline of how to use the Overview Screen most effectively in practice.

Aims

You have opened the Overview Screen to see on which units of your system there are faults. You want to see which unit caused the problem and what triggered it. Finally, you want to be able to move specific system components in order to rectify the fault.



Overview Screen (As Shown on OP25)

On Which Units are there Faults?

First of all, you want to be able to see on which units there are faults.

▲ ▼ On an OP, you can use these keys to move the cursor through the list. All units with faults are identified by a warning triangle.

On a TP, you can select the unit you want by touching it on the screen.

In order to be able to move more quickly between the units with faults, you can use this key to change the Display Mode.

The cursor then moves directly from one unit with a fault to the next.

On Which Unit did a Fault Occur First?

The unit on which the fault occurred first is identified by a flashing warning triangle. There is a very strong possibility that the cause of the fault is to be found here and that the other faults are consequential on the original fault.

Information About the Unit

You select the unit with the flashing warning triangle. In the top section of the screen you can now see detailed information about that unit, i.e. block type, block number, text assigned to the unit and step numbers of the active action and parallel actions (see *What You See on the Overview Screen (Chapter 5.3.2)*).

Detailed Analysis

If the cause of the fault is not obvious, you will want to investigate the fault more thoroughly in order to see which logical operation results in the program code triggered the error message. To do so, use this key to call up the Detail Screen.

Changing to Manual Mode

If you know what has caused the fault, you will naturally want to rectify it as quickly as possible so that the system can be started up again. To that end, you can execute specific movements on particular units in Manual mode.

Note
It depends on your PLC program whether you are able to and need to change to Manual mode before executing manual operations.

To change the operating mode, select the unit on which you wish to carry out a movement.

If there are other hierarchically subordinate units related to that unit, this symbol appears above the list of units (see *Hierarchical Units in the Overview Picture (Chapter 5.3.6)*).

On an OP, you can use this key to move down a hierarchical level and define your selection even more precisely.

On a TP, you have to press this key to do this.

Finally, you open the text or graphic list for selecting the operating modes using the ENTER key on an OP and by touching the displayed operating mode on a TP.

Executing Movements

Once you have selected the unit or subunit that you wish to move and have set the correct operating mode, use this key to switch to the Movement Screen.

Setting or resetting a step

If a unit has been programmed in S7-GRAPH, you can use this key to the Step Screen and then set or reset individual steps of a sequence.

Exiting the Overview Screen

You use this key to return to the Diagnosis Start Screen.

Or you can use this key to switch to the Message Screen. There you can watch whether other faults occur.

5.3.5 Changing the Display Mode

Display Modes

▲ ▼ If you are using an OP as your operating unit, you can specify whether the cursor keys move the cursor in the Overview Screen one unit at a time or directly from one unit with a fault to the next.

 To toggle between display modes, use this key.

When to Use Which Mode

Moving directly from one unit with a fault to the next is particularly useful if your system has a large number of individual units. If, however, you wish to select a unit without a fault (e.g. to execute a movement), you must switch back to the display mode that allows you to select units with or without faults.

How to Tell Which Mode is Active

The display mode that is active at any particular time is indicated by a graphical symbol on the operating unit as follows:

⚠ This symbol appears above the list of units when direct navigation between units with faults is active.

The symbol does not appear when the display mode which allows you to select units with or without faults is active.

5.3.6 Hierarchical Units on the Overview Screen

Hierarchical Units

When programming a PLC it is possible – depending on the programming language used – to define a hierarchy of individual units. Thus in the case of S7-PDIAG a unit can be equated with a block which as a rule also represents a process unit. By virtue of the multi-instance concept of STEP 7 a unit can also contain other units.

As soon as at least one subunit has a fault, the immediately superior unit is also marked as having a fault. The marker is thus passed on from one level to the next right up to the highest hierarchical level.

Note
If the PLC has been programmed in S7-GRAPH there are no hierarchical units.

Identifying Hierarchical Units

You can tell whether there are subordinate or superior units related to a particular unit by means of graphical symbols shown on the operating unit. They appear above the list of units. They always relate to the unit currently selected by the cursor.

 indicates that there is a superior unit

 indicates that there is a subordinate unit

 indicates that there is a superior unit and subordinate units

In order to be able to tell whether there are more hierarchical levels related to a unit, you thus proceed as follows:

1. Select the unit in question.
2. Observe the symbol displayed.

Changing Hierarchical Level

To change the hierarchical level proceed as follows:

1. Select the unit whose subordinate or superior units you wish to display.
2. Change the hierarchical level:

    On an OP, press this key if you wish to display the subordinate units, or

    press this key if you want to call up the superior unit.

    On a TP, press this key if you wish to display the subordinate units, or

    press this key if you want to call up the superior unit.

When you move down a hierarchical level, only the subordinate units of the selected unit are shown.

When you move up a hierarchical level, all units on that level are once again displayed.

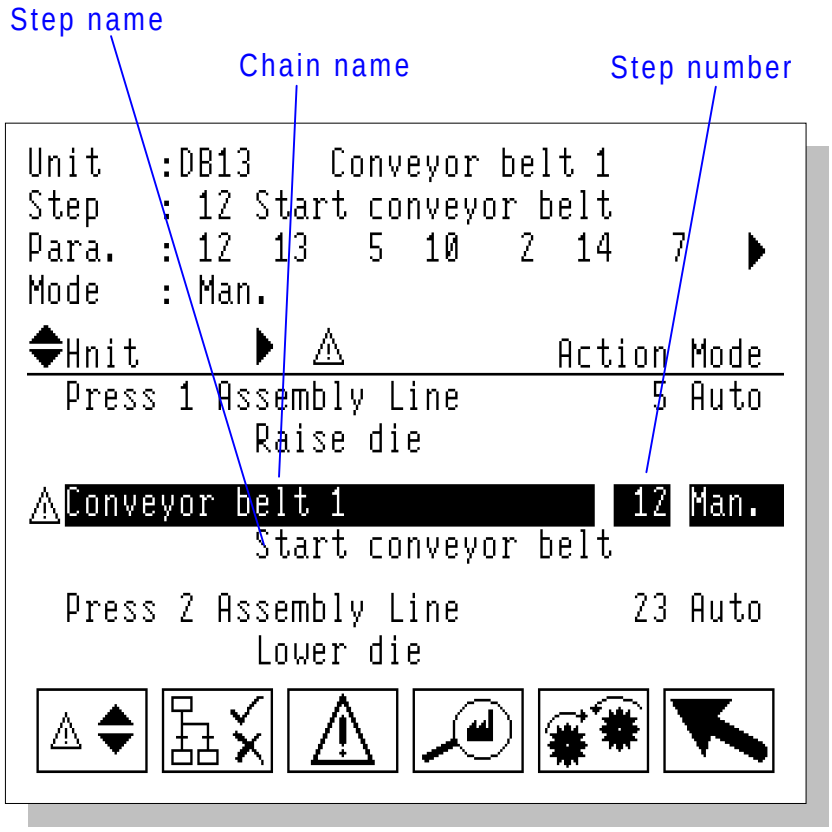
5.3.7 Alternative Overview Screen for S7-GRAPH

If your system has units programmed in S7-GRAPH, you can use, – depending on the configuration, – a slightly modified form of the Overview Screen.

Layout

The list of units extends over two lines for this version of the overview screen. The top line corresponds to the entry on the standard overview screen and shows the unit name, number of the active step and, where appropriately programmed, the operating mode for units programmed in S7-GRAPH. The step name of the active step is displayed beneath it as well.

Display of the remaining fields and operation are similar to the standard overview screen.



Alternative Overview Screen for S7-GRAPH (As Shown on OP25)

5.4 Step Screen

5.4.1 What is the Step Screen Used for?

Display

The step screen shows the unit selected on the overview screen (from which you opened the step screen) together with its name and the current step with number and name.

If the unit was programmed with **S7-GRAPH**, you can activate a certain step in the sequence of steps or deactivate one or all steps to obtain certain processes specifically for diagnostic purposes.

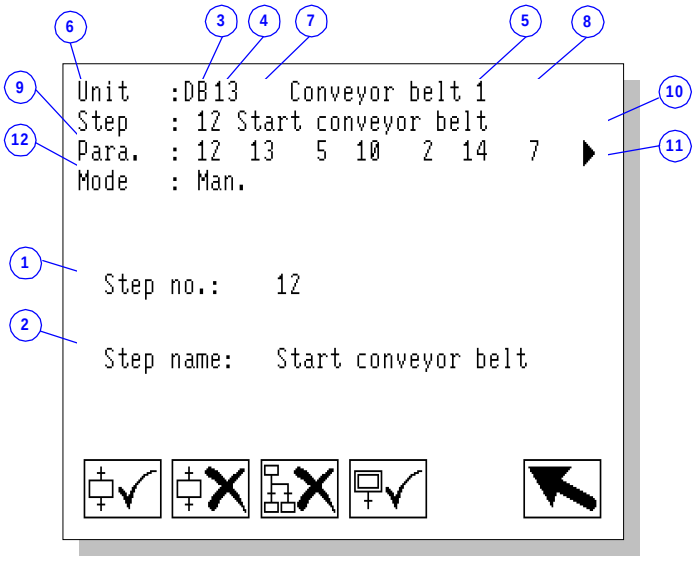
If the unit was programmed with **S7-PDIAG**, a system message is issued. Since steps cannot be defined with STL and LAD together with S7-PDIAG, you can indeed see the step screen, but cannot set or reset steps.

5.4.2 What You See on the Step Screen

General Layout

Like all the diagnosis screens, the step screen has a standardized layout. There are only minor differences between the various types of operating units.

The illustration below shows an example of the step screen as it appears on an OP25.



Step Screen (As Shown on OP25)

Note that no display appears in areas (1), (2) and (6) through (11) if the selected unit was programmed with **S7-PDIAG**. Steps cannot then be set and deleted.

Information on the selected step

You will see the step number and step name in the center area of the display.

(1) The wording `step No.` and the user number of the active step appear here. If several actions are active at the same time, the step number of the action that appears first on the list at (10) is shown.
Here you can enter the required step number of the current unit that you want to set or delete.

(2) The wording `step name` and, following confirmation by pressing ENTER, the name of the step entered under (1) appear here.

Information on the Selected Unit

In the upper area of the display you obtain information on the unit selected in the overview screen from which the step screen was opened.

(3) This shows the block type of the selected unit, i.e. FC, DB or OB.

(4) This field shows the block number of the selected unit.

(5) This shows text assigned to the unit: the symbol for the block or an absolute name.

(6) If the unit has been programmed in **S7-GRAPH** the word `Step` appears.

(7) If the selected unit has been programmed in **S7-GRAPH** the user number of the active step appears here. If several actions are active at the same time, the step number of the action that appears first on the list at (10) is shown.

(8) If the selected unit has been programmed in **S7-GRAPH** the step name appears.

(9) If the selected unit has been programmed in **S7-GRAPH** the word `Para.` appearsto identify the subsequent numbers as parallel steps.

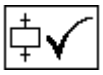
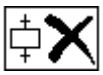
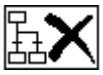
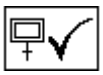
(10) If the selected unit has been programmed in **S7-GRAPH** the numbers of the active actions appear in these fields. The numbers of the actions with faults always appear first reading from left to right. Actions with faults are shown flashing.

(11) The *arrow right* symbol appears here if there are more parallel actions than can be shown at (10) at once.

(12) Here you can specify the operating mode of the selected unit. The operating modes that are possible depend on how the unit has been programmed. If the STEP 7 program does not define an operating mode, this field remains blank.

5.4.3 Keys on the Step Screen

You can use the following keys on the step screen:

	You use this key to set (enable) the displayed step in the step sequence.
	You use this key to reset the displayed step in the step sequence.
	You use this key to reset all the steps in the step sequence.
	You use this key to reset the initial step in the step sequence.
	You use this key to return to the Overview Screen.

Keys on the step screen

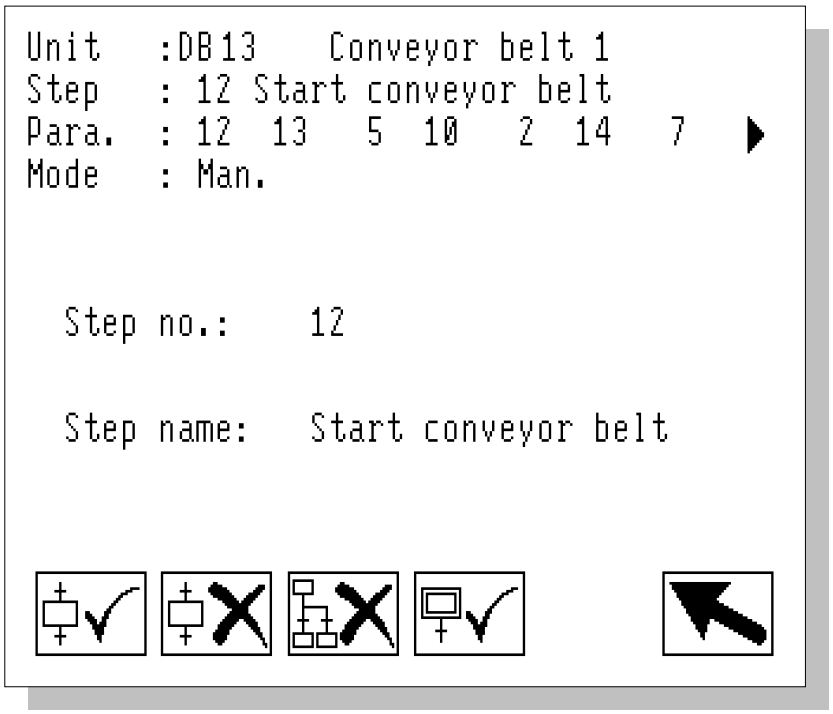
5.4.4 How to Work with the Step Screen

This chapter gives a general outline of how to use the step screen most effectively in practice.

Aims

You have opened the step screen to enable or disable one or more steps in the sequencer.

This means that you can specifically move individual system components as necessary in order to continue with the diagnosis or clear the malfunction.



Step Screen (As Shown on OP25)

Selecting a step

One of the active steps of the unit selected on the overview screen is preassigned on the step screen. To set or delete the step you want in the step sequence, enter its number directly on the operator panel and confirm by pressing ENTER. On a TP, touch the input/output field and enter the step number. The name of the step then appears on the line below the input field.

Enabling a step

If you wish to enable the step you entered, press this key. The number of the enabled step then appears on the third line of the step screen.

Disabling a step

If you wish to disable the step you entered, press this key. The number of the step is deleted from the corresponding line of the step screen.

Deactivating all steps

If you wish to disable all steps, press this key. The numbers of the steps are deleted from the corresponding line of the step screen.

Enabling an initial step

If you wish to enable the initial step of the step sequence, press this key. The number of the enabled step then appears on the third line of the step screen.

Limited number of simultaneously active steps

Depending on how the PLC is programmed, only a limited number of simultaneously active steps is allowed. As soon as this number is exceeded upon enabling, the step concerned no longer appears in the list of active steps. You can then enable the required step only after you have deleted another, active step.

5.5 Movement Screen

5.5.1 The Purpose of the Movement Screen

Movements

The Movement Screen helps you when rectifying a fault or operating the installation. It allows you to execute specific movements for individual units manually by means of keys. For example, you could move the die of a stamping press back to its starting position before removing a jammed workpiece.

Each movement can be executed in two directions, e.g. in/out, open/close, up/down, forward/backwards.

Blocked Movements

If a movement is blocked and can therefore not be executed, this is indicated clearly on the Movement Screen.

Target Positions

The Movement Screen also shows which target positions have already been passed. This means that on a stamping press, for example, you could see what the current position of the die is. If the movement is blocked you can see at what point it was blocked.

Basic Requirements

A PLC must have been suitably programmed in order that movements can be executed from the operating unit. The UDT "Movement" must be used and appropriately wired up. More detailed information on programming movements is provided in the S7-PDIAG manual.

Note
Movements can not be defined when programming in S7-GRAPH. But in S7-GRAPH you can assign movements from S7-PDIAG to a unit.

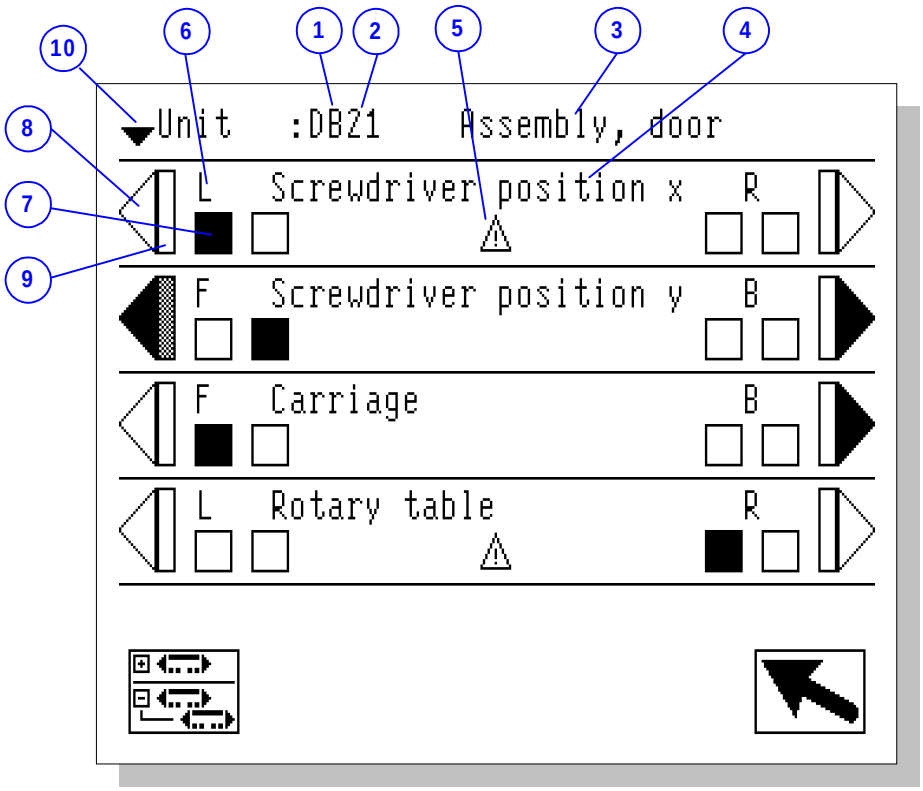
5.5.2 What You See on the Movement Screen

The Movement Screen shows a list of all movements that can be executed for a unit.

General Layout

Like all the diagnosis screens, the Movement Screen has a standardized layout. There are only minor differences between the various types of operating unit.

The illustration below shows an example of the Movement Screen as it appears on an OP25.



Movement Screen (As Shown on OP25)

Information About the Unit

The first line shows information about the selected unit. The selected unit is that unit of your system for which the movements are displayed further down the screen.

Which unit is the selected unit depends on where the Movement Screen was activated from.

- If you have activated the Movement Screen from the Message Screen, the selected unit is determined by the alarm message that was highlighted by the cursor when the Overview Screen was quit. The unit to which that alarm message is attributable becomes the selected unit on the Movement Screen.
- If you have activated the Movement Screen from the Overview Screen, the selected unit is the unit that was highlighted by the cursor when the Overview Screen was quit.

If there are a number of hierarchical levels between the units, the unit on the highest hierarchical level is always displayed (see *Hierarchical Units on the Movement Screen (Chapter 5.5.5)*).

Specifically, the information about the selected unit is made up of the following details:

(1) the block type

(2) the block number.

(3) the block symbol or an absolute identifier.

List of Movements

Below the information line for the selected unit the movements are displayed.

The individual movements are listed one below the other on separate lines and separated by a ruled line.

Their order of display corresponds to the sequence of screen numbers and position numbers which can be assigned as attributes when you program the movement blocks in S7-PDIAG. If no default values are specified at that stage, or if individual positions are assigned twice over (including on several CPUs), the order is arbitrary.

Each movement can be executed in two directions, e.g. in/out, open/close, up/down, forward/backwards. One direction of movement is symbolized by the left side of the screen and the other by the right side.

The two keys immediately to the left and right of the representation of the movement are assigned to each movement. These keys are used to execute the movements.

Each movement line is made up of the following elements:

(4) This shows you what movements are involved. The text is assigned to the movement when the unit is programmed (variable name of movement). Only the last two components of the variable name, which are separated by ".", are displayed.

The mode for enabling movements can be set in such a way that a movement has to be selected first before it is enabled (default setting on the TP). When you then select a movement, it is displayed in inverted, i.e. in reverse video (see *Changing The Mode of Enabling Movements (Chapter 8.4.6)*).

(5) If this movement is disturbed, a *warning triangle* is appears to indicate the fault.

(6) This shows you which direction of movement is symbolized by which side of the screen. Those are the directions in which the movement will be executed when you press the appropriate key.

(7) Here you are shown a symbolic representation of various target positions. A target position corresponds to a specific limit of movement (e.g. a specific conveyor position, a specific angle of rotation, etc.). Each movement can have more than one target position. The reaching of a target position does not necessarily mean that the maximum physical limit of movement has been reached.

If a target position has not yet been reached, it is shown as an empty rectangle.

If a target position has been reached or passed, the symbol appears as a solid rectangle.

Note
For the different devices you will see explanatory text for each target position below the symbols if stored in the PLC program.

(8) The triangle in the margin of the movement shows you whether a movement can be executed.

If the movement can be executed, the triangle appears as a solid area.

If the movement can not be executed, either because it is blocked or because it is locked by a locking condition (e.g. furthest target position already reached), the triangle appears in outline only.

(9) The rectangle next to the triangle flashes while the movement is being executed.

(10) If there are more movements than can be displayed on the display, you can scroll the list of movements up or down.

You recognize this by the fact that one of these symbols appears on the left next to the unit.

5.5.3 Movement Screen Keys

You can use the following keys on the Movement Screen:

Side keys	The keys at the sides are used to activate the individual movements. A movement can only be executed if the associated triangle symbol appears with a solid inner area. If the symbol appears in outline only, the movement can not be carried out. The mode for enabling movements can be configured in ProTool in such a way that a movement has to be selected first before it is enabled (default setting on the TP). Execution of the movement continues for as long as you keep the key pressed. If the movement is successfully executed, the rectangle next to the triangle flashes. If you use *direct keys (Chapter 8.6.1)*, the keys communicate directly with the PLC which is of particular interest where critical-timing and safety-related functions are involved. The PLC program must be capable of supporting the direct keys.
	If there are more movements for a unit than can be displayed on the operating unit at once, you can scroll the list up or down using the cursor keys. To scroll up on a touch panel, touch the top most movement until scrolling is activated. To scroll down, touch one of the other movements.
	This key is used to specify whether only the movements of the selected (superior) unit are displayed or all movements of subordinate units as well (see *Hierarchical Units on the Movement Screen (Chapter 5.5.5)*). The (superior) unit concerned is the unit selected on the screen from which the Movement Screen was activated.
	This key is used to return to the screen from which you opened the Movement Screen.

Movement Screen Keys

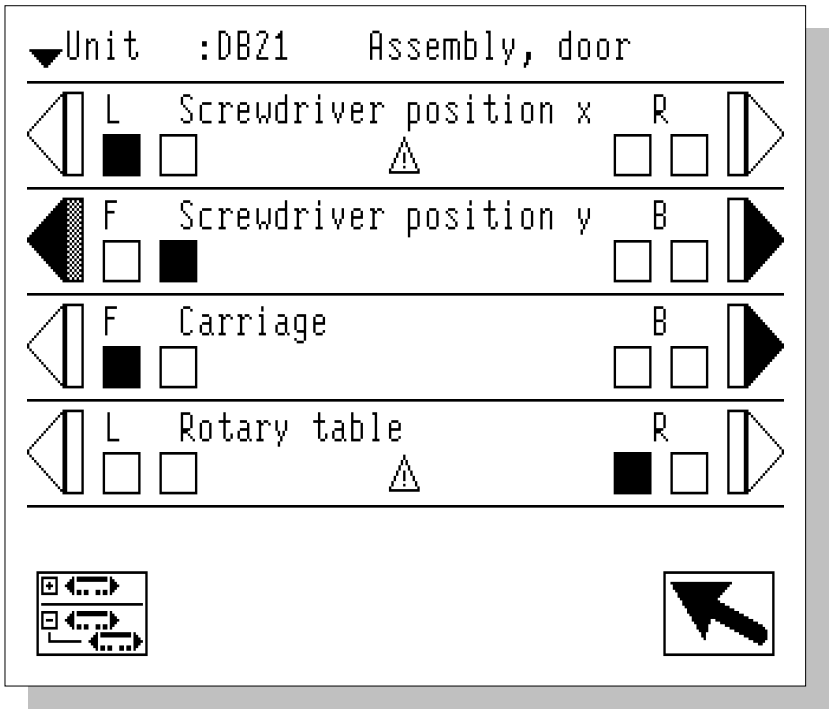
5.5.4 How to Work with the Movement Screen

This chapter gives a general outline of how to use the Movement Screen most effectively in practice.

Aims

First of all, you will have opened the Message Screen or the Overview Screen. There you will have selected an alarm message or a unit and subsequently opened the Movement Screen.

Now you want to eliminate the fault and execute certain movements manually on the unit with the fault. You also want to see which movements are blocked.



Movement Screen (As Shown on OP25)

Which Unit?

You check the top line of the display to make sure that you are on the right unit as only the movements of that unit are displayed.

Which Movements?

The rest of the screen lists all the available movements one below the other on separate lines. You can scroll the list up or down if there are more possible movements than can be shown on the screen at once. In the top left corner of the screen there are small arrows indicating the presence of additional movements.

If a unit also has hierarchically subordinate units, you can use this key to view the movements of those subunits as well (see *Hierarchical Units on the Movement Screen (Chapter 5.5.5)*).

Which Faults?

If a movement is blocked, this symbol appears in the centre of the line below the name of the movement.

Whether a movement can be executed in a particular direction is indicated by the triangle symbols at either end of each line:

- A filled-in symbol indicates that the movement can be carried out in the specified direction.
- If the symbol appears in outline only, the movement can not be carried out in the specified direction.

Note
The fact that a movement can not be executed does not mean that is must be blocked. There may be exclusion criteria specified in the PLC program or the maximum limit of movement may already have been reached.

Executing a Movement

You have now found the movement that you wish to execute and established that it is not blocked and can be executed.

On an OP, execute the movement by pressing the soft key to which the relevant triangle symbol is pointing (that is, to the left or right next to the display).

On a TP, proceed as follows:

1. Select the movement to enable it to be operated.
2. Execute the movement by touching the appropriate triangle symbol.

If you do not execute a movement within a specific length of time, the movement selected is automatically deselected again and thus disabled.

Warning
The corresponding bit is still set on the PLC even if a movement is not possible. Subsequent handling depends on the PLC program.

Tracking Movement Progression

The small rectangle next to the triangle flashes while the movement is being executed.

As soon as a particular target position is reached, the corresponding target position symbol changes its appearance as follows:

☐ Target position not yet reached

■ Target position reached or passed

Exiting the Movement Screen

 This key returns you to the screen from which you activated the Movement Screen.

5.5.5 Hierarchical Units on the Movement Screen

Hierarchical Units

When programming a PLC it is possible – depending on the programming language used – to define a hierarchy of individual units. Thus in the case of S7-PDIAG a unit can be equated with a block which as a rule also represents a process unit. By virtue of the multi-instance concept of STEP a unit can also contain other units.

Display Mode

The Movement Screen always shows all movements for a specific unit of your system. Which unit that is depends on where the Movement Screen was activated from (see *What You See on the Movement Screen (Chapter 5.5.2)*).

If there are a number of hierarchical levels between the units of a system, the Movement Screen initially shows only the movements for the current unit.

If you wish to execute movements for subordinate units, you have to change the display mode.

Changing Display Mode

 To view the movements for subordinate units, press this key.

After the display mode has been changed, all movements of subordinate units are shown.

To hide the movements for subordinate units again, press the same key again.

5.6 Detail Screen

5.6.1 The Purpose of the Detail Screen

Analysis of Criteria

Retracing an error to the relevant points in the program code is referred to as analysis of criteria. The Detail Screen shows the results of the analysis of criteria.

Signal list, STL or LAD

Depending on the configuration, the diagnosis result is initially displayed in a signal list restricted to the most essential items, in a detailed instruction list (STL) or as ladder diagram (LAD). A key allows you to switch easily between the three display formats.

Note
Both Detail Screen display formats are basically the same in effect but they differ in the way in which the information is presented and how they are used. For that reason they are described in separate chapters.

The LAD display format does not allow all commands to be represented, however. The following are permissible:

`U op, UN op, U(, O op, ON op, O(, O, ), NOT, = op, S op, R op, X, X(, XN, XN(, Label`

(`op`=operand; `Label` only at start of network, `U` corresponds to `A` in IEC display mode)

If a command which can not be represented in LAD format needs to be displayed, a system message appears. You can then use the key to switch to the signal-list display.

Program Excerpt

The display of the STEP 7 program code itemizes the sections of the PLC program that have "triggered" a process fault. This should not be confused with a programming error.

Instead, the occurrence of a process fault has brought about a specific condition the incidence of which the process is monitored for. That condition is characteristic of a system fault and an alarm message is issued.

Since the process diagnosis system can monitor a whole range of conditions and mutual interdependencies can also be defined, it is of course of interest to see which signals have led to the issue of an alarm message.

From that information it is possible to deduce what the cause of the fault was and how it can be most quickly rectified.

Additional Information

In addition to the program code, you can also view operands, symbols and remarks. At the same time, you are shown the status of the operands and all results of logical operations.

All signals whose conditions have contributed to the alarm message are identified. In that way you can see at a glance which conditions have led to the issue of an alarm message.

5.6.2 Detail Screen as Signal List

5.6.2.1 What you see in the Detail Screen (Signal List)

Faults Displayed

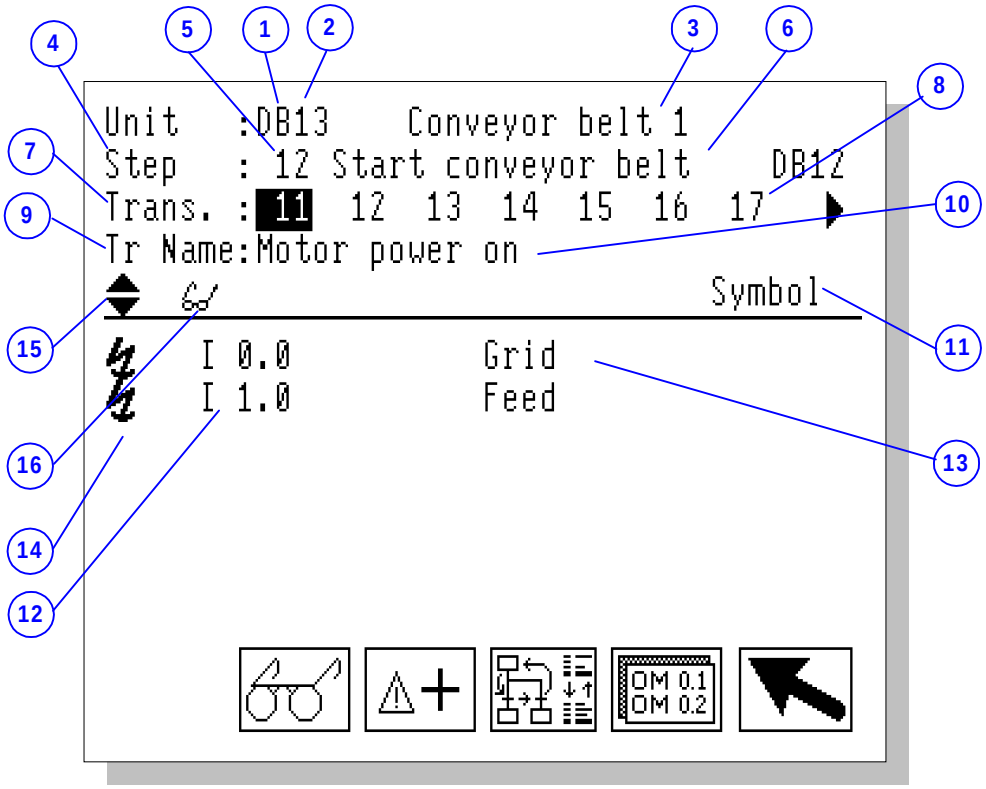
The faults displayed when the Detail Screen is opened depend on the point from which the Detail Screen is called up:

- If you have called up the Detail Screen from the Message Screen (or from the Message Page/Window) you will have first had to select a message. The Detail Screen then shows the fault which triggered the message you have selected on the Message Screen.
- If you have called up the Detail Screen from the Overview Screen you will have first had to select a unit. The Detail Screen then shows the fault in the first action of that unit with a fault.

General Layout

Like all the diagnosis screens, the Detail Screen has a standardized layout. There are only minor differences between the various types of operating unit.

The illustration below shows an example of the Detail Screen in Signal List format as it appears on an OP25. You can find an illustration and a description of the STL variation in the chapter *What You Can See in the Detail Screen (STL) (Chapter 5.6.3.1)*, you can find an illustration and description of the LAD variation in the chapter *What You Can See in the Detail Screen (LAD) (Chapter 5.6.4.1)*.



Detail Screen (example of signal-list format on an OP25 programmed with S7–GRAPH)

Information About the Unit

The top section of the display shows detailed information relating to the unit on which the process fault occurred. The display distinguishes between areas (4) to (11) depending on whether the unit has been programmed with S7-PDIAG or with S7-GRAPH.

(1) This shows the block type of the unit with the fault, i.e. FC, DB or OB.

(2) This field shows the block number of the unit with the fault.

(3) At this point text assigned to the unit appears: the symbol for a block or an absolute identifier.

If the unit has been programmed with **S7-GRAPH**, lines 2 to 4 of the display have the following contents:

(4) This field identifies the step selected by means of the test `Step`.

(5) This field displays the user number of the step selected.

(6) This field displays a text that is assigned to the step displayed under (5).

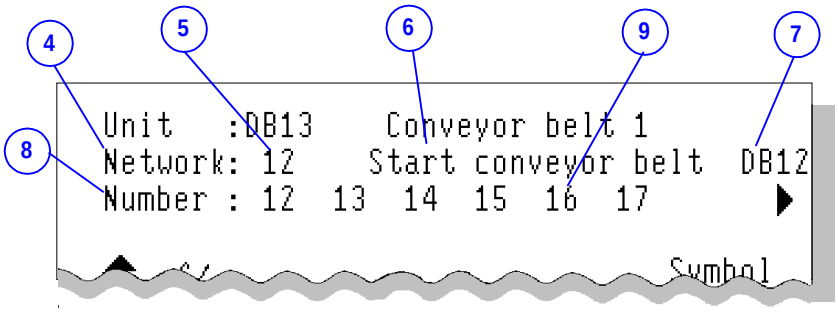
(7) This field displays the text `Transi.` for "Transitions".

(8) This field displays the numbers of the transitions of the step displayed. The transition displayed is highlighted in inverse type. If step monitoring view is displayed rather than a transition, then, accordingly, the step number is highlighted.

(9) This field displays the text `Tr Name` for "Transition Name". The field remains blank if the locking condition of the step is shown.

(10) This field displays the name of the transition displayed. The field remains blank if the locking condition of the step is shown.

If the unit has been programmed with **S7-PDIAG**, lines 2 and 3 of the display look as follows:



Detail Screen (example of signal-list format on an OP25 programmed with S7–PDIAG)

(4) This field displays the text `Netw.` for the network selected.

(5) This field displays the number of the network displayed.

(6) This field displays the name of the network displayed.

(7) This field displays the module in which the network was configured.

(8) This field displays the text `Number` for "Network Number".

(9) This field displays the network numbers of networks that set the same operand.

Line 4 of the display remains blank when the unit is programmed with **S7-PDIAG**.

There are no differences between programming with S7-GRAPH and with S7-PDIAG with regard to the remaining areas of the Detail Screen.

Changing the Display Mode

(11) In this input/output field you can see or specify whether symbols or remarks relating to the individual instructions are to be shown at (13).

Representation of the Network

The center section of the screen shows an excerpt from the program code for the network with the fault. Only the signals that trigger an Alarm Message are shown here.

Specifically, you are shown the following:

(12) The individual operands. If SIMATIC display mode is set, the SIMATIC names are displayed, otherwise the international IEC names are shown (see *Switching Over SIMATIC/IEC Display Mode (Chapter 8.4.5)*)

(13) Symbol or remark for the signal as per the text or graphic list or remarks list in Step 7 If the operating unit display does not provide sufficient space to show symbol and remark parallel to one another, you can toggle between the symbol display and the remarks display (see *Toggle Between Symbol and Remarks (Signal List) (Chapter 5.6.2.6)*).

In the case of tags within DBs, only the symbolism is displayed if a symbolic identifier has been stored in the symbol table. If no symbol has been created, the operating unit only shows the absolute address of the tag.

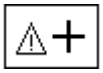
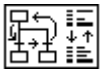
(14) A *lightning flash* symbol appears here because the signal shown next to it has led to an alarm message.

(15) If there are more instructions than can be displayed on the operating unit at one time, the *arrow right* and *arrow left* symbols appear. You can then scroll the display up or down.

(16) A *spectacle* symbol appears here if the current status is displayed rather than the status at the time of occurrence of the faults (initial values) (see *Toggling Display of Initial Values and Current Status (Signal List) (Chapter 5.6.2.4)*).

5.6.2.2 Keys in the Detail Screen (Signal List)

You can use the following keys on the Detail Screen in signal list display mode:

	If there are more instructions than can be displayed on the operating unit at one time, you can scroll the list up or down using the cursor keys. To scroll up the list on a touch panel, touch the top most line until scrolling is activated. To scroll down, touch one of the other lines. If you are able to scroll, an arrow symbol that indicates the possible scroll direction appears above the statement list.
	On an OP you can use the ENTER key to open a list for selecting whether symbols or remarks relating to the individual instructions are to be displayed (device-dependent). On a TP you can open the same list by touching the display.
	This key is used to determine what status is displayed: values at the time of occurrence of the fault (initial values) or the current values (see *Toggling Display of Initial Values and Current Status (Signal List) (Chapter 5.6.2.4)*).
	You use this key to toggle **to the next fault** - in other words, to the next faulty action of this unit (refer to *Changing the Action or Transition (Signal List) (Chapter 5.6.2.5)*). With units programmed with S7-GRAPH and using movement blocks created with S7-PDIAG, the change is made initially to all other transitions and then to the movement blocks.
	You use this key to change **within an error**. The change is normally to the next transition (see *Changing the Action or Transition (Signal List) (Chapter 5.6.2.5)*). In the case of Multiple Assignments to a monitored operand the change is to the next network containing an assignment to that operand.
	This key is used to change the display to STL format (see *What You See on the Detail Screen (STL Format) (Chapter 5.6.3.1)*).
	This key is used to return to the screen from which you opened the Signal List Display.

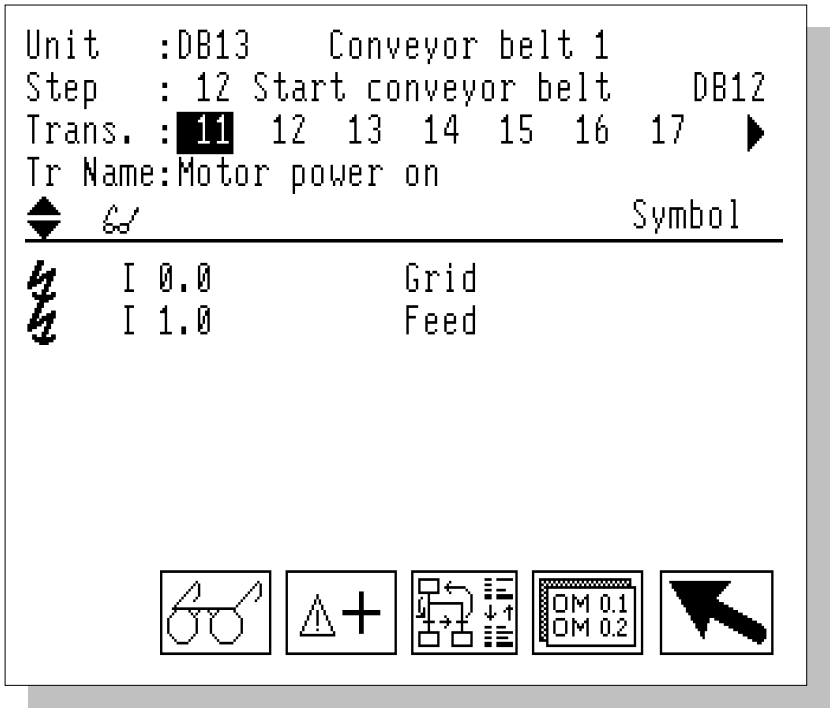
Keys Used with Signal List Display in the detail screen

5.6.2.3 How you work with the Detail Screen (Signal List)

This chapter gives a general outline of how to use the Detail Screen (Signal List) in practice.

Aims

You have opened the Detail Screen in order to see which signals have resulted in a particular alarm message. By doing so you can tell which monitoring routine triggered the error message and accordingly where the fault is to be found.



Detail Screen (Signal List Format As Shown on OP25)

The middle section of the display shows only the signals that have just triggered an Alarm Message.

Which Unit?

The first line of the display shows you to which unit the signals shown underneath belong. You are given details of the block type, block number and assigned text (symbol or absolute identifier).

Which Step? Which Transition?

In S7-GRAPH units the second line shows the user number of the active step and an associated text. On the third line you will see the transitions belonging to each step. The transition to which the program code displayed belongs is highlighted in inverse type. The fourth line shows the name of that transition.

Which Network?

In S7-PDIAG units the second line shows the number and the name of the network displayed. On the third line the wording `Number` appears, and on the fourth line the network numbers of networks appear that set the same operand.

Changing Display Mode

If you prefer to see the information displayed in STL format, you can use this key to switch from Signal List to STL display mode. If you then press the corresponding key again, the LAD mode will be displayed. If you then press the corresponding key again, the display will return to the Signal List mode. The icon on the key always indicates the mode that will be shown next.

Deducing Information

You can see the individual operands, symbols and remarks in the signal list.

All operands that have led to the issue of an alarm message are identified by this symbol.

This means you can see right away where your fault monitoring system gave the alarm. If you examine the instructions concerned, you will quickly be able to locate the cause of the fault.

Additional Actions, Transitions and Networks

You use this key to change to the next error - in other words, to the next fault action of the unit.

Use this key within the same fault to switch to the next transition or the next network that could have triggered this fault.

You will find details of this in the chapter called *Changing the Action or Transition (Signal List) (Chapter 5.6.2.5)*).

Modifying the View Options

There are a number of ways in which you can adapt the view options to suit your personal preferences.

If you wish, you can have the current status displayed instead of the status displayed at the time the error occurred. To do so, use this key (see *Toggling Display of Initial Values and Current Status (Signal List) (Chapter 5.6.2.4)*).

Device-specific for OP: If you wish to view the symbols and remarks relating to the individual instructions, use the ENTER key to open the corresponding list box (see *Toggling Display of Symbol and Remarks (Signal List) (Chapter 5.6.2.6)*).

On a TP, you open this same list by touching the corresponding input/output field.

Exiting the Detail Screen

This key returns you to the screen from which you activated the Detail Screen.

5.6.2.4 Toggling between initial values and current status (Signal List)

The default setting is for display of the status as it was at the time the fault monitoring routine first detected the process fault. For that reason the displayed values are also referred to as **initial values**.

In addition, you can also inquire the current status. Viewing the current status allows you to monitor "online" what effect corrective measures have on the condition of the system.

This allows you to recognize immediately when the fault is corrected: signals are no longer shown on the display.

To toggle display of initial values and current status, use this key.

When the display mode is set to current status, this symbol appears above the statement list.

5.6.2.5 Switching to action or transition (Signal List)

You can easily switch to other actions (steps) and transitions simply by pressing a key.

Changing Action

A unit may have more than one fault at the same time. Use key combination to switch to the next fault in the same unit. The action of the unit affected by this fault will be displayed.

 Press this key to switch to the next fault.

Display of the steps and transitions in the top section of the screen then changes accordingly (see *What You See on the Detail Screen (Signal List)(Chapter 5.6.2.1)*).

Note
Once all actions of a unit have been run through and the unit concerned has other hierarchically subordinate units, the function moves on to the actions of those units. This means that you do not need to return to the Overview Screen and select a hierarchically subordinate unit there in order to be able to see the actions with faults on the subunit.

Change transition or network

Sometimes the cause of a fault cannot be recognized at first glance:

- In S7-PDIAG units the detail screen always shows one network only. However, the cause of the fault may be located in more than one network.
- In the same way, with S7-GRAPH units the interlocking condition of the step or individual transitions could be the cause of the error message.

   Use this key to switch from one possible cause of a fault to the next:

  - With S7-PDIAG units from one associated network to the next
  - With S7–GRAPH units that report an interlocking fault, from the interlocking condition of the step to the first and then to all other transitions
  - With S7–GRAPH units that report a monitoring fault, from one transition to the next.
  - With units programmed with S7-GRAPH and using movement blocks created with S7-PDIAG, the change is made initially between the transitions and then to the movement blocks.

The display of the transitions in the third and fourth lines is changed accordingly (see *What You See on the Detail Screen (Signal List) (Chapter 5.6.2.1)*). Once the last transition has been reached, the locking condition of the step is displayed and the cycle starts again from the beginning.

You can tell which transition is currently being displayed from the inverted transition number. If the locking condition is being displayed, the inverted step number is displayed.

Multiple Assignments of Monitored Operands

With *Multiple Assignments (Chapter 5.6.5.3)* to a monitored operand, the cause of the error may reside on different networks.

 You can use this key to switch between the networks affected.

You can see which network is currently being displayed from the second line of the detail screen. Hover, the block number displayed on the first line remains as it is.

5.6.2.6 Switch between symbol and remark (Signal List)

An instruction can be assigned a symbol and remarks in STEP 7. On the Detail Screen (Signal List) these are then shown at the end of each line.

Note
If no symbol or remarks were stored, the absolute operand is shown.

Depending on the device, the space available only allows either symbols only or remarks only to be displayed.

In order to toggle between display of symbols and remarks, press the ENTER key on an OP. A text or graphic list then opens from which you can select the required display mode.

On a TP, you open the same list by touching the corresponding input/output field (that is, the word "Symbol" or "Remark").

5.6.3 Detail Screen in STL Format

5.6.3.1 What You See on the Detail Screen (STL Format)

Faults Displayed

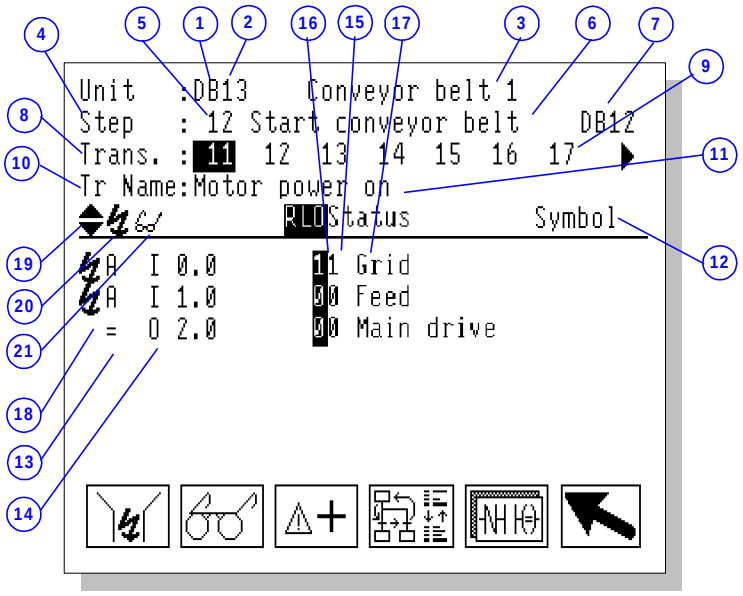
The faults displayed when the Detail Screen is opened depend on the point from which the Detail Screen is called up:

- If you have called up the Detail Screen from the Message Screen (or from the Message Page/Window) you will have first had to select a message. The Detail Screen then shows the fault which triggered the message you have selected on the Message Screen.
- If you have called up the Detail Screen from the Overview Screen you will have first had to select a unit. The Detail Screen then shows the fault in the first action of that unit with a fault.

General Layout

Like all the diagnosis screens, the Detail Screen has a standardized layout. There are only minor differences between the various types of operating unit.

The illustration below shows an example of the Detail Screen in STL format as it appears on an OP25. You can find an illustration and a description of the list variations in the chapter *What You Can See in the Detail Screen (Signal List) (Chapter 5.6.2.1)*, you can find an illustration and description of the LAD variation in the chapter *What You Can See in the Detail Screen (LAD) (Chapter 5.6.4.1)*.



Detail Screen (example of STL format on an OP25 programmed with S7–GRAPH)

Information About the Unit

The top section of the display shows detailed information relating to the unit on which the process fault occurred. The display distinguishes between areas (4) to (11) depending on whether the unit has been programmed with S7-PDIAG or with S7-GRAPH.

(1) This shows the block type of the unit with the fault, i.e. FC, DB or OB.

(2) This field shows the block number of the unit with the fault.

(3) At this point text assigned to the unit appears: the symbol for a block or an absolute identifier.

If the unit has been programmed with **S7-GRAPH**, lines 2 to 4 of the display have the following contents:

(4) This field identifies the step selected by means of the test `Step`.

(5) This field displays the user number of the step selected.

(6) This field displays a text that is assigned to the step displayed under (5).

(7) This field displays the module in which the network was configured.

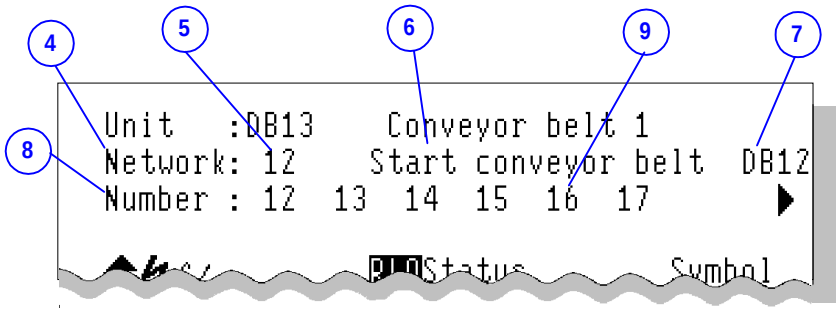
(8) This field displays the text `Transi.` for "Transitions".

(9) This field displays the numbers of the transitions of the step displayed. The transition displayed is highlighted in inverse type. If step monitoring view is displayed rather than a transition, then, accordingly, the step number is highlighted.

(10) This field displays the text `Tr Name` for "Transition Name". The field remains blank if the locking condition of the step is shown.

(11) This field displays the name of the transition displayed. The field remains blank if the locking condition of the step is shown.

If the unit has been programmed with **S7-PDIAG**, lines 2 and 3 of the display look as follows:



Detail Screen (example of STL format on an OP25 programmed with S7–PDIAG)

(4) This field displays the text `Netw.` for the network selected.

(5) This field displays the number of the network displayed.

(6) This field displays the name of the network displayed.

(7) This field displays the module in which the network was configured.

(8) This field displays the text `Number` for "Network Number".

(9) This field displays the network numbers of networks that set the same operand.

Line 4 of the display remains blank when the unit is programmed with **S7-PDIAG**.

There are no differences between programming with S7-GRAPH and with S7-PDIAG with regard to the remaining areas of the Detail Screen.

Changing the Display Mode

(12) In this input/output field you can see or specify whether symbols or remarks relating to the individual instructions are to be shown at (17).

Representation of the Network

The center section of the screen shows an excerpt from the program code for the network with the fault. The instructions which have led to the issue of an alarm message are highlighted.

Specifically, you are shown the following:

(13) The operators. If SIMATIC display mode is set, the SIMATIC names are displayed, otherwise the international IEC names are shown (see *Switching Over SIMATIC/IEC Display Mode (Chapter 8.4.5)*)

(14) The individual operands. Here too, the display depends on whether SIMATIC or IEC display mode is set.

(15) the operand status. The information displayed relates either to the values at the time of occurrence of the fault (initial values) or the current status (see *Toggling Display of Initial Values and Current Status (STL) (Chapter 5.6.3.5)*).

(16) The corresponding logical operation result.

(17) Symbol or remark for the signal as per the text or graphic list or remark list in Step 7 If the operating unit display does not provide sufficient space to show symbol and remark parallel to each another, you can toggle between the symbol display and the remarks display (see *Toggle Between Symbol and Remark (Signal List) (Chapter 5.6.2.6)*).

In the case of tags within DBs, only the symbolism is displayed if a symbolic identifier has been stored in the symbol table. If no symbol has been created, the operating unit only shows the absolute address of the tag.

(18) A *lightning flash* symbol appears here if the signal shown next to it has led to an alarm message.

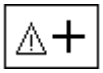
(19) If there are more instructions than can be displayed on the operating unit at one time, the *arrow right* and *arrow left* symbols appear. You can then scroll the display up or down.

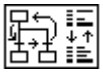
(20) A *lightning flash* symbol appears here if partial view is active - this lists only those instructions that have set the monitored signal to the incorrect status. (Refer to *Toggling Between Partial and Full View (STL Format) (Chapter 5.6.3.4)*).

(21) A *spectacles* symbol appears here if the current status bits are displayed rather than the status bits at the time of occurrence of the fault (initial values) (see *Toggling Display of Initial Values and Current Status (STL) (Chapter 5.6.3.5)*).

5.6.3.2 Detail Screen Keys (STL)

You can use the following keys on the Detail Screen in STL display mode:

▼▲	If there are more instructions than can be displayed on the operating unit at one time, you can scroll the list up or down using the cursor keys. To scroll up the list on a touch panel, touch the top most line until scrolling is activated. To scroll down, touch one of the other lines. If you are able to scroll, an arrow symbol that indicates the possible scroll direction appears above the statement list.
	On an OP you can use the ENTER key to open a list for selecting whether symbols or remarks relating to the individual instructions are to be displayed (device-dependent). On a TP you can open the same list by touching the display.
	This key is used to toggle between partial and full view (see *Toggling Between Partial and Full View (STL Format) (Chapter 5.6.3.4)*). Partial view shows only those instructions that have led to a fault.
	This key is used to determine what status and therefore which logical operation results are shown, i.e. the values at the time of occurrence of the fault (initial values) or the current values (see *Toggling Display of Initial Values and Current Status (STL) (Chapter 5.6.3.5)*).
	You use this key to change **to the next error** - in other words, to the next faulty action of this unit (refer to *Changing the Action or Transition (STL) (Chapter 5.6.3.6)*). With units programmed with S7-GRAPH and using movement blocks created with S7-PDIAG, the change is made initially to all other transitions and then to the movement blocks.

	You use this key to change **within an error**. The change is normally to the next transition (see *Changing the Action or Transition (STL) (Chapter 5.6.3.6)*). In the case of Multiple Assignments to a monitored operand the change is to the next network containing an assignment to that operand.
	This key is used to change the display to LAD format (see *What You See on the Detail Screen (LAD Format) (Chapter 5.6.4.1)*).
	This key is used to return to the screen from which you opened the STL Display.

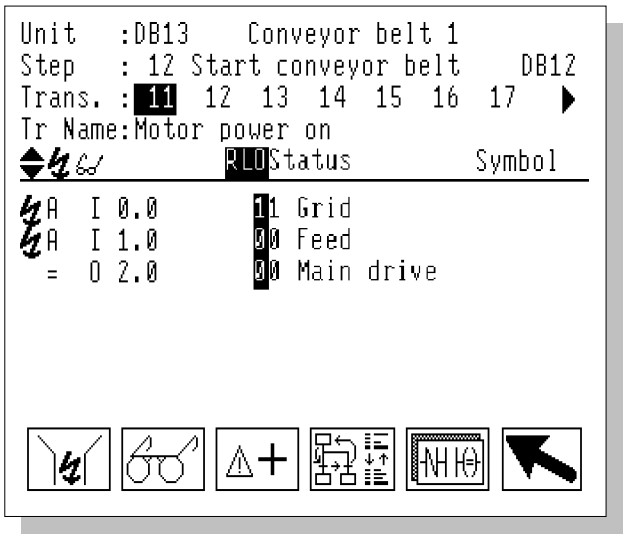
Keys Used with Detail Screen in STL Display Mode

5.6.3.3 How to Work with the Detail Screen (STL)

This chapter gives a general outline of how to use the Detail Screen (STL) in practice.

Aims

You have opened the Detail Screen in order to see which instructions in the program have resulted in a particular alarm message. By doing so you can tell which monitoring routine triggered the error message and accordingly where the fault is to be found.



Detail Screen (STL Format As Shown on OP25)

The center section of the screen shows an excerpt from the program code for the networks with the fault. The instructions which have led to the issue of an alarm message are highlighted.

Which Unit?

The first line of the display shows you to which unit the excerpt from the program code shown underneath belongs. You are given details of the block type, block number and assigned text (symbol or absolute identifier).

Which Step? Which Transition?

In S7-GRAPH units the second line shows the user number of the active step and an associated text. On the third line you will see the transitions belonging to each step. The transition to which the program code displayed belongs is highlighted in inverse type. The fourth line shows the name of that transition.

Which Network?

In S7-PDIAG units the second line shows the number and the name of the network displayed. On the third line the wording `Number` appears, and on the fourth line the network numbers of networks appear that set the same operand.

You now have the information you need to correctly place the program code displayed.

Changing Display Mode

If you prefer to see the information displayed in LAD format, you can use this key to switch from STL to LAD display mode. If you then press the corresponding key again, the symbol table mode will be displayed. If you then press the corresponding key again, the display will return to the STL mode. The icon on the key always indicates the mode that will be shown next.

Deducing Information

The statement list shows the individual operators and operands, status bits, logical operation results, symbols and remarks.

All instructions that have led to the issue of an alarm message are identified by this symbol.

This means you can see right away where your fault monitoring system gave the alarm. If you examine the instructions concerned, you will quickly be able to locate the cause of the fault. The logical operation results will help you in that regard.

Additional Actions, Transitions and Networks

You use this key to change to the next error - in other words, to the next fault action of the unit.

Use this key within the same fault to switch to the next transition or the next network that could have triggered this fault.

You will find details of this in the chapter called *Changing the Action, Transition or Network (STL) (Chapter 5.6.3.6)*).

Modifying the View Options

There are a number of ways in which you can adapt the view options to suit your personal preferences.

If you want to be able to view all signals, i.e. including those that have not led to a fault, press this key (see *Toggling Between Partial and Full View (STL Format) (Chapter 5.6.3.4)*).

If you wish, you can have the current status bits displayed instead of the displayed initial values (status bits at the time the error occurred). To do so, use this key (see *Toggling Display of Initial Values and Current Status (STL) (Chapter 5.6.3.5)*).

Device-specific for OP: If you wish to view the symbols and remarks relating to the individual instructions, use the ENTER key to open the corresponding list box (see *Toggling Display of Symbol and Remarks (STL) (Chapter 5.6.3.7)*).

On a TP, you open this same list by touching the corresponding input/output field.

Exiting the Detail Screen

This key returns you to the screen from which you activated the Detail Screen.

5.6.3.4 Toggling Between Partial and Full View (STL Format)

You can choose whether to

- view all instructions of the network displayed (= full view) or
- view only those instructions that have set the monitored signal to the incorrect status (= partial view)

 To toggle between the two display modes, use this key.

 When partial view is active, this symbol appears above the statement list.

Partial view is particularly useful if you want to be able to quickly locate the critical instructions that have resulted in the issue of an alarm message.

If you project does not specify otherwise, partial view is automatically selected when the screen is selected.

5.6.3.5 Toggling Display of Initial Values and Current Status (STL)

The default setting is for display of the status bits as they were at the time the fault monitoring routine first detected the process fault. For that reason those values are also referred to as **initial values**.

Those status bits are accordingly also the basis for the results of logical operations (RLO) displayed.

In addition, you can also inquire the current status. Viewing the current status allows you to monitor "online" what effect corrective measures have on the condition of the system.

If you have set the display mode to partial view (see *Toggling Between Partial and Full View (STL Format) (Chapter 5.6.3.4)*) you can see right away if the fault has been put right. In that case, no more signals are displayed on the screen.

 To toggle display of initial values and current status, use this key.

 When the display mode is set to current status, this symbol appears above the statement list.

5.6.3.6 Changing the Action or Transition (STL)

You can easily switch to other actions (steps) and transitions simply by pressing a key.

Changing Action

A unit may have more than one fault at the same time. Use key combination to switch to the next fault in the same unit. The action of the unit affected by this fault will be displayed.

 Press this key to switch to the next fault.

Display of the steps and transitions in the top section of the screen then changes accordingly (see *What You See on the Detail Screen (STL Format) (Chapter 5.6.3.1)*).

Note
Once all actions of a unit have been run through and the unit concerned has other hierarchically subordinate units, the function moves on to the actions of those units. This means that you do not need to return to the Overview Screen and select a hierarchically subordinate unit there in order to be able to see the actions with faults on the subunit.

Change transition or network

Sometimes the cause of a fault cannot be recognized at first glance:

- In S7-PDIAG units the detail screen always shows one network only. However, the cause of the fault may be located in more than one network.
- In the same way, with S7-GRAPH units the interlocking condition of the step or individual transitions could be the cause of the error message.

 Use this key to switch from one possible cause of a fault to the next:

  - With S7-PDIAG units from one associated network to the next
  - With S7–GRAPH units that report an interlocking fault, from the interlocking condition of the step to the first and then to all other transitions
  - With S7–GRAPH units that report a monitoring fault, from one transition to the next.
  - With units programmed with S7-GRAPH and using movement blocks created with S7-PDIAG, the change is made initially between the transitions and then to the movement blocks.

The display of the transitions in the third and fourth lines then changes accordingly (see *What You See on the Detail Screen (STL) (Chapter 5.6.3.1)*). Once the last transition has been reached, the locking condition of the step is displayed and the cycle starts again from the beginning.

You can tell which transition is currently being displayed from the inverted transition number. If the locking condition is being displayed, the inverted step number is displayed.

Multiple Assignments of Monitored Operands

With *Multiple Assignments (Chapter 5.6.5.3)* to a monitored operand, the cause of the error may reside on different networks.

 You can use this key to switch between the networks affected.

You can see which network is currently being displayed from the second line of the detail screen. Hover, the block number displayed on the first line remains as it is.

5.6.3.7 Toggling Display of Symbol and Remarks (STL)

An instruction can be assigned a symbol and remarks in STEP 7. On the Detail Screen (STL) these are then shown at the end of each line.

Note
If no symbol or remarks were stored, the absolute operand is shown.

Depending on the device, the space available only allows either symbols only or remarks only to be displayed.

In order to toggle between display of symbols and remarks, press the ENTER key on an OP. A text or graphic list then opens from which you can select the required display mode.

On a TP, you open the same list by touching the corresponding input/output field (that is, the word "Symbol" or "Remark").

5.6.4 Detail Screen in LAD Format

5.6.4.1 What You See on the Detail Screen (LAD Format)

Faults Displayed

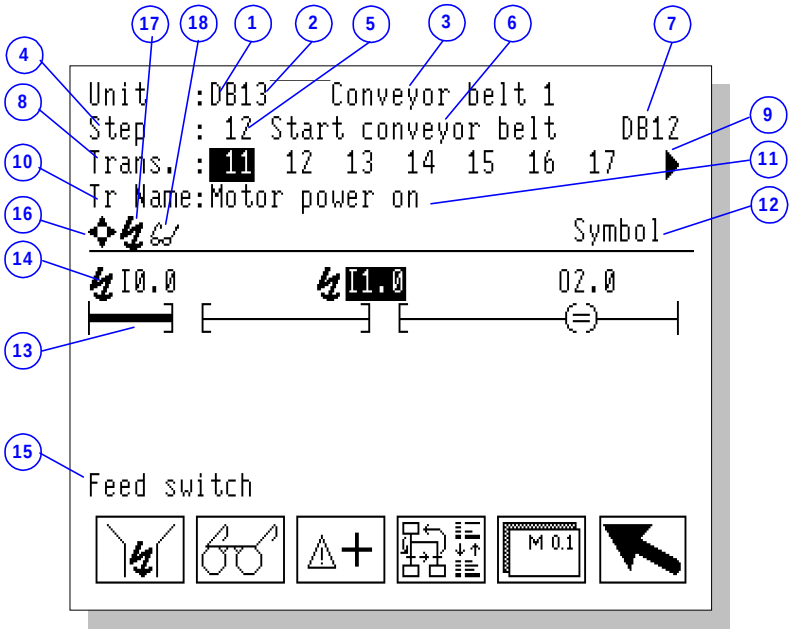
The faults displayed when the Detail Screen is opened depend on the point from which the Detail Screen is called up:

- If you have called up the Detail Screen from the Message Screen (or from the Message Page/Window) you will have first had to select a message. The Detail Screen then shows the fault which triggered the message you have selected on the Message Screen.
- If you have called up the Detail Screen from the Overview Screen you will have first had to select a unit. The Detail Screen then shows the fault in the first action of that unit with a fault.

General Layout

Like all the diagnosis screens, the Detail Screen has a standardized layout. There are only minor differences between the various types of operating unit.

The illustration below shows an example of the Detail Screen in LAD format as it appears on an OP25. You can find an illustration and a description of the list variations in the chapter *What You Can See in the Detail Screen (Signal List) (Chapter 5.6.2.1)*, you can find an illustration and description of the STL variation in the chapter *What You Can See in the Detail Screen (STL) (Chapter 5.6.3.1)*.



Detail Screen (example of LAD format on an OP25 programmed with S7–GRAPH)

Information About the Unit

The top section of the display shows detailed information relating to the unit on which the process fault occurred. The display distinguishes between areas (4) to (11) depending on whether the unit has been programmed with S7-PDIAG or with S7-GRAPH.

(1) This shows the block type of the unit with the fault, i.e. FC, DB or OB.

(2) This field shows the block number of the unit with the fault.

(3) At this point text assigned to the unit appears: the symbol for a block or an absolute identifier.

If the unit has been programmed with **S7-GRAPH**, lines 2 to 4 of the display have the following contents:

(4) This field identifies the step selected by means of the test `Step`.

(5) This field displays the user number of the step selected.

(6) This field displays a text that is assigned to the step displayed under (5).

(7) This field displays the module in which the network was configured.

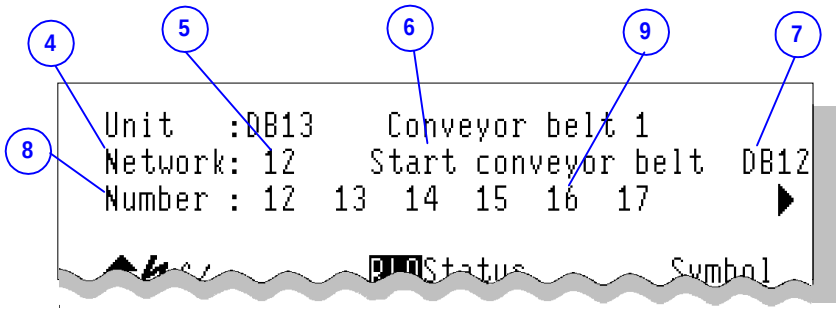
(8) This field displays the text `Transi.` for "Transitions".

(9) This field displays the numbers of the transitions of the step displayed. The transition displayed is highlighted in inverse type. If step monitoring view is displayed rather than a transition, then, accordingly, the step number is highlighted.

(10) This field displays the text `Tr Name` for "Transition Name". The field remains blank if the locking condition of the step is shown.

(11) This field displays the name of the transition displayed. The field remains blank if the locking condition of the step is shown.

If the unit has been programmed with **S7-PDIAG**, lines 2 and 3 of the display look as follows:



Detail Screen (example of LAD format on an OP25 programmed with S7–PDIAG)

(4) This field displays the text `Netw.` for the network selected.

(5) This field displays the number of the network displayed.

(6) This field displays the name of the network displayed.

(7) This field displays the module in which the network was configured.

(8) This field displays the text `Number` for "Network Number".

(9) This field displays the network numbers of networks that set the same operand.

Line 4 of the display remains blank when the unit is programmed with **S7-PDIAG**.

There are no differences between programming with S7-GRAPH and with S7-PDIAG with regard to the remaining areas of the Detail Screen.

Changing the Display Mode

(12) In this input/output field you can see or specify whether symbols, remarks or operands relating to the individual instructions are to be shown at (15).

Representation of the Network

The center section of the screen shows an excerpt from the program code for the network with the fault.

Specifically, you are shown the following:

(13) The switches. An actuated switch is represented by a bold symbol, a disabled switch by a feint symbol.

(14) The operands. If SIMATIC display mode is set, the SIMATIC operand names are displayed, otherwise the international (IEC) names are displayed (see *Switching Over SIMATIC/IEC Display Mode (Chapter 8.4.5)*)

(15) An additional line of text showing in full the operand, symbol or remarks relating to the switch that is highlighted. The display mode can be toggled (see *Toggling Display of Operand, Symbol and Remarks (LAD) (Chapter 5.6.4.7)*).

In the case of tags within DBs, only the symbolism is displayed if a symbolic identifier has been stored in the symbol table. If no symbol has been created, the operating unit only shows the absolute address of the tag.

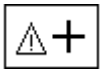
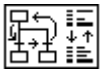
(16) The arrow symbols appear here. They indicate the directions in which you can move the cursor.

(17) A *lightning flash* symbol appears here is partial view is active - this shows only those switches that have led to an alarm message (see *Toggling Between Partial and Full View (LAD) (Chapter 5.6.4.4)*).

(18) A *spectacles* symbol appears here if the current status is displayed rather than the status at the time of occurrence of the faults (initial values) (see *Toggling Display of Initial Values and Current Status (LAD) (Chapter 5.6.4.5)*).

5.6.4.2 Detail Screen Keys (LAD)

You can use the following keys on the Detail Screen in LAD display mode:

	On an OP, you can use the cursor keys to move the cursor though the network displayed. On the left above the ladder diagram appears a small arrow for each direction in which you can move. On a TP, you can select a switch simply by touching it. To scroll on an OP, move the cursor past the edge of the display. The screen is moved and regenerated accordingly. To scroll on a TP, touch the outermost switch in the scroll direction until the scrolling is activated.
	On an OP you can use the ENTER key to open a list for selecting whether symbols or remarks relating to the individual instructions are to be displayed (device-dependent). On a TP you can open the same list by touching the display.
	This key is used to toggle between partial and full view (see *Toggling Between Partial and Full View (LAD) (Chapter 5.6.4.4)*). Partial view shows only those operands that have led to a fault being triggered.
	This key is used to determine what status and therefore which logical operation results are shown, i.e. the values at the time of occurrence of the fault (initial values) or the current values (see *Toggling Display of Initial Values and Current Status (LAD) (Chapter 5.6.4.5)*).
	You use this key to change **to the next error** - in other words, to the next faulty action of this unit (refer to *Changing the Action or Transition (LAD) (Chapter 5.6.4.6)*). With units programmed with S7-GRAPH and using movement blocks created with S7-PDIAG, the change is made initially to all other transitions and then to the movement blocks.
	You use this key to change **within an error**. The change is normally to the next transition (see *Changing the Action or Transition (LAD) (Chapter 5.6.4.6)*). In the case of Multiple Assignments to a monitored operand the change is to the next network containing an assignment to that operand.
	This key is used to change the display to signal-list format (see *What You See on the Detail Screen (Signal List) (Chapter 5.6.2.1)*).
	This key is used to return to the screen from which you opened the LAD Display Mode.

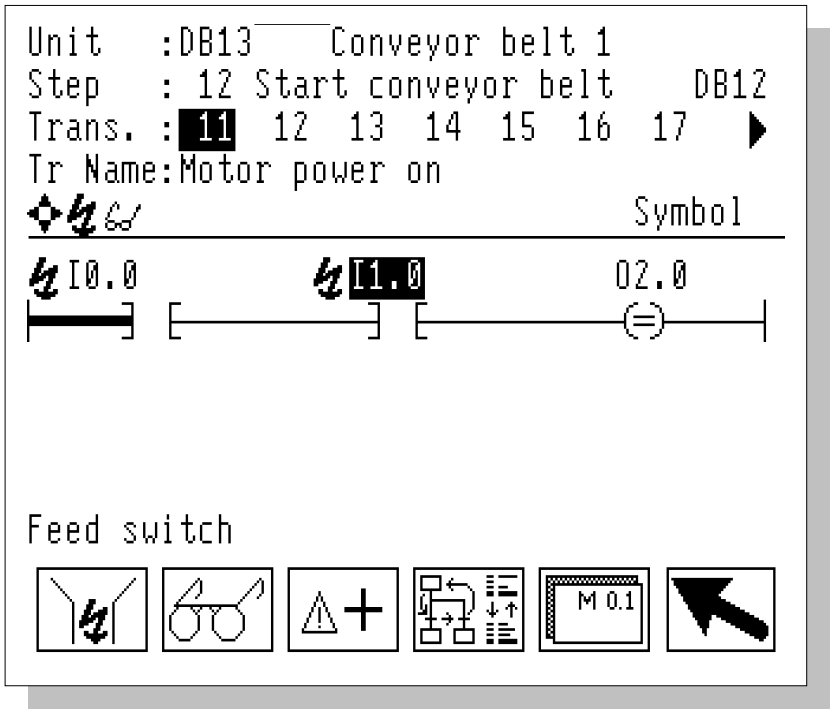
Keys Used with Detail Screen in LAD Display Mode

5.6.4.3 How to Work with the Detail Screen (LAD)

This chapter gives a general outline of how to use the Detail Screen (LAD) in practice.

Aims

You have opened the Detail Screen in order to see which instructions in the program have resulted in a particular alarm message. By doing so you can tell which monitoring routine triggered the error message and accordingly where the fault is to be found.



Detail Screen (LAD Format As Shown on OP25)

The center section of the screen shows an excerpt from the program code for the networks with the fault.

Which Unit?

The first line of the display shows you to which unit the network shown underneath belongs. You are given details of the block type, block number and assigned text (symbol or absolute identifier).

Which Step? Which Transition?

In S7-GRAPH units the second line shows the user number of the active step and an associated text. On the third line you will see the transitions belonging to each step. The transition to which the program code displayed belongs is highlighted in inverse type. The fourth line shows the name of that transition.

Which Network?

In S7-PDIAG units the second line shows the number and the name of the network displayed. On the third line the wording `Number` appears, and on the fourth line the network numbers of networks appear that set the same operand.

You now have the information you need to correctly place the program code displayed.

Changing Display Mode

If you prefer to see the information displayed in symbol table format, you can use this key to switch from LAD to symbol list display mode. If you then press the corresponding key again, the STL mode will be displayed. If you then press the corresponding key again, the display will return to the LAD mode. The icon on the key always indicates the mode that will be shown next.

Deducing Information

The ladder diagram shows the individual switches and operands. The status bits are identified by virtue of the thickness of the line used to represent the switch.

- actuated switches are represented by bold symbols
- disabled switches are represented by feint symbols

With this information, you can easily ascertain at what point your fault monitoring system gave the alarm and how the fault occurred.

Additional Actions, Transitions and Networks

You use this key to change to the next error - in other words, to the next fault action of the unit.

Use this key within the same fault to switch to the next transition or the next network that could have triggered this fault.

You will find details of this in the chapter called *Changing the Action or Transition (LAD) (Chapter 5.6.4.6)*).

Modifying the View Options

There are a number of ways in which you can adapt the view options to suit your personal preferences.

If you want to be able to view all signals, i.e. including those that have not led to a fault, press this key (see *Toggling Between Partial and Full View (LAD) (Chapter 5.6.4.4)*).

If you wish, you can have the current status bits displayed instead of the displayed initial values (status bits at the time the error occurred). To do so, use this key (see *Toggling Display of Initial Values and Current Status (LAD) (Chapter 5.6.4.5)*).

Device-specific: If you wish to view the symbols and remarks relating to the individual instructions, use the ENTER key to open the corresponding list box (see *Toggling Display of Symbol and Remarks (LAD) (Chapter B)*).

On a TP, you open this same list by touching the corresponding input/output field.

Exiting the Detail Screen

This key returns you to the screen from which you activated the Detail Screen.

5.6.4.4 Toggling Between Partial and Full View (LAD Format)

You can choose whether to

- view all instructions of the network displayed (= full view) or
- view only those instructions that have set the monitored signal to the incorrect status (= partial view)

To toggle between the two display modes, use the this key.

When partial view is active, this symbol appears above the ladder diagram.

Partial view is particularly useful if you want to be able to quickly locate the critical instructions that have resulted in the issue of an alarm message.

If you project does not specify otherwise, partial view is automatically selected when the screen is selected.

5.6.4.5 Toggling Between Initial Values and Current Status (LAD)

The default setting is for display of the status as it was at the time the fault monitoring routine first detected the process fault. For that reason those values are also referred to as **initial values**.

Those values are accordingly also the basis for the results of logical operations.

In addition, you can also inquire the current status. Viewing the current status allows you to monitor "online" what effect corrective measures have on the condition of the system.

If you have set the display mode to partial view (see *Toggling Between Partial and Full View (LAD Format) (Chapter 5.6.4.4)*) you can see right away if the fault has been put right. In that case, no more signals are displayed on the screen.

 To toggle display of initial values and current status, use this key.

 When the display mode is set to current status, this symbol appears above the statement list.

5.6.4.6 Changing the Action or Transition (LAD)

You can easily switch to other faulty actions and transitions by pressing a key.

Changing Action

A unit may have more than one fault at the same time. Use key combination to switch to the next fault in the same unit. The action of the unit affected by this fault will be displayed.

 Press this key to switch to the next fault.

Display of the steps and transitions in the top section of the screen then changes accordingly (see *What You See on the Detail Screen (LAD) (Chapter 5.6.4.1)*).

Note
Once all actions of a unit have been run through and the unit concerned has other hierarchically subordinate units, the function moves on to the actions of those units. This means that you do not need to return to the Overview Screen and select a hierarchically subordinate unit there in order to be able to see the actions with faults on the subunit.

Change transition or network

Sometimes the cause of a fault cannot be recognized at first glance:

- In S7-PDIAG units the detail screen always shows one network only. However, the cause of the fault may be located in more than one network.
- In the same way, with S7–GRAPH units the interlocking condition of the step or individual transitions could be the cause of the error message.

 Use this key to switch from one possible cause of a fault to the next:

  – With S7-PDIAG units from one associated network to the next

  – With S7–GRAPH units that report an interlocking fault, from the interlocking condition of the step to the first and then to all other transitions

  – With S7–GRAPH units that report a monitoring fault, from one transition to the next.

  – With units programmed with S7–GRAPH and using movement blocks created with S7-PDIAG, the change is made initially between the transitions and then to the movement blocks.

The display of the transitions in the third and fourth lines then changes accordingly (see *What You See on the Detail Screen (LAD) (Chapter 5.6.4.1)*). Once the last transition has been reached, the locking condition of the step is displayed and the cycle starts again from the beginning.

You can tell which transition is currently being displayed from the inverted transition number. If the locking condition is being displayed, the inverted step number is displayed.

Multiple Assignments of Monitored Operands

With *Multiple Assignments (Chapter 5.6.5.3)* to a monitored operand, the cause of the error may reside on different networks.

 You can use this key to switch between the networks affected.

You can see which network is currently being displayed from the second line of the detail screen. Hover, the block number displayed on the first line remains as it is.

5.6.4.7 Toggling Display of Operand, Symbol and Remarks (LAD)

An instruction can be assigned a symbol and remarks in STEP 7. You can have these displayed on the Detail Screen (LAD) as well.

The bottom line of the screen shows the operand, symbol or remarks relating to the switch highlighted on the ladder diagram.

To toggle between display of operand, symbols and remarks proceed as follows:

1. Select the switch for which you would like to have the relevant information displayed.
2. On an OP, press the ENTER key. A text or graphic list then opens from which you can select the required display mode.

   On a TP, you open the same list by touching the corresponding input/output field (that is, the word "Address", "Symbol" or "Remark").

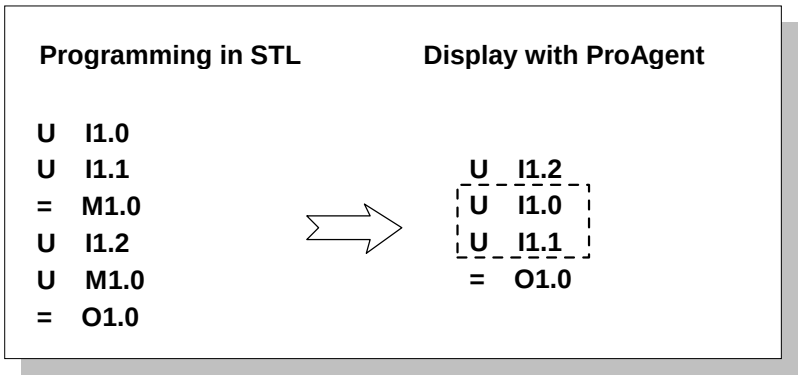
Note
If no symbol or remarks were stored, the absolute operand is shown.

5.6.5 Enhanced Possibilities with S7-PDIAG

5.6.5.1 Reference Networks

The program code displayed by ProAgent is not always absolutely identical with the program code that was entered in LAD/FUP/STL. In order to provide you with as meaningful an excerpt as possible, corresponding **reference networks** are created, if possible.

For example, ProAgent shows the complete assignment instead of a flag:

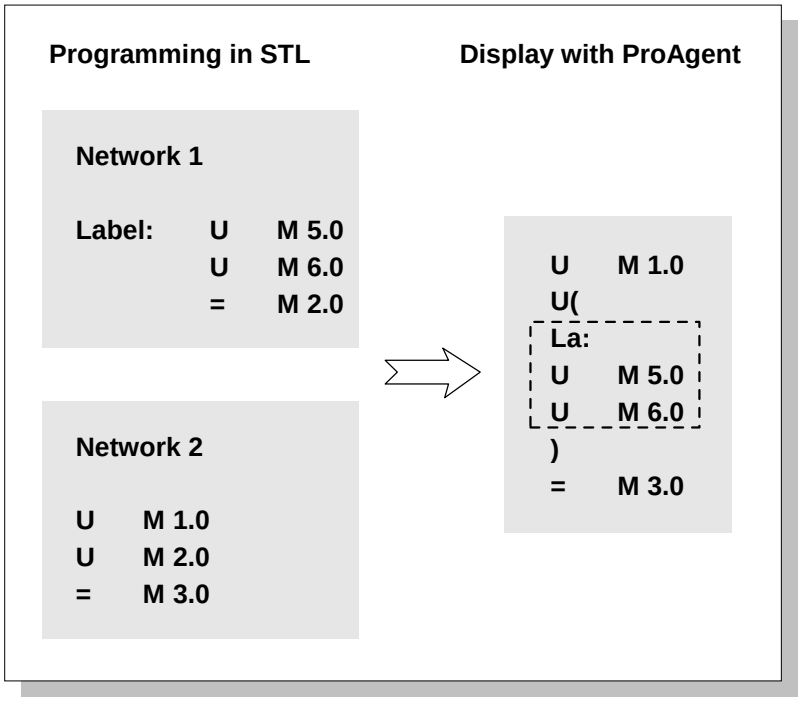


Forming Auxiliary Networks

5.6.5.2 Branch Instructions

ProAgent's criteria analysis is in a position to resolve even complex PLC programs with labels and display them on the operating unit.

The display is such that all code parts that can be evaluated become visible.



Resolving Branch Instructions

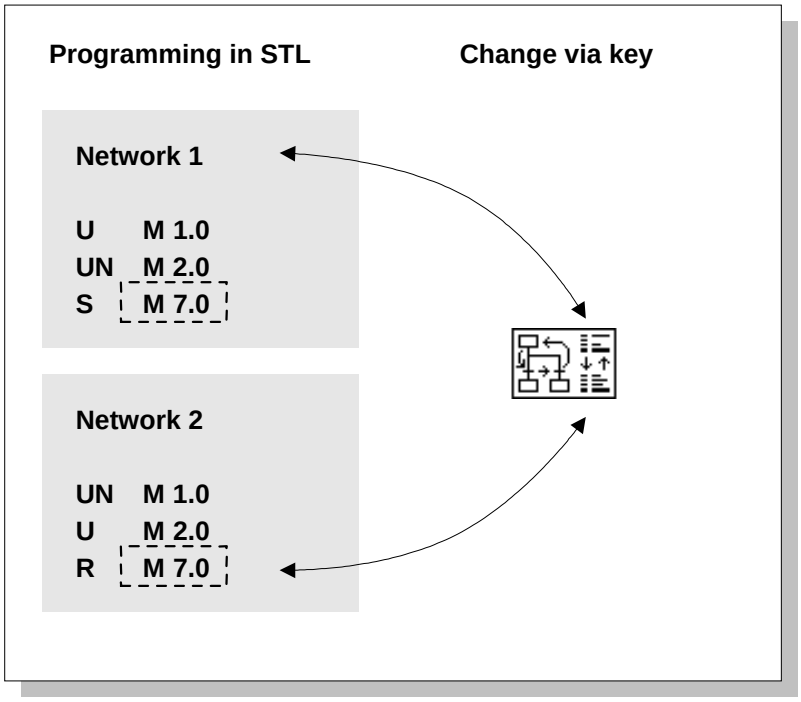
Labels Outside the Start of the Network

In the LAD display mode of the detail screen, display is possible only if the label is at the start of the network. In the STL and Signal List display mode, display is possible at all times, but the display unit sets the initial query in the case of labels. The following statement is the basically treated like the start of a network.

Caution
This behavior may differ from actual execution on the PLC. This may result in differences between logical results displayed on the operating unit and those actually present on the PLC.

5.6.5.3 Multiple Assignments

If your PLC program performs multiple assignments to a monitored operand - for example, with SET/RESET or even with a direct assignment - you can change from one affected network to another on the detail screen by means of a key.



Multiple Assignment of the Monitored Operand M 7.0

You can see which network is currently being displayed from the second line of the detail screen.

5.6.5.4 Exclusion Operands

What are Exclusion Operands?

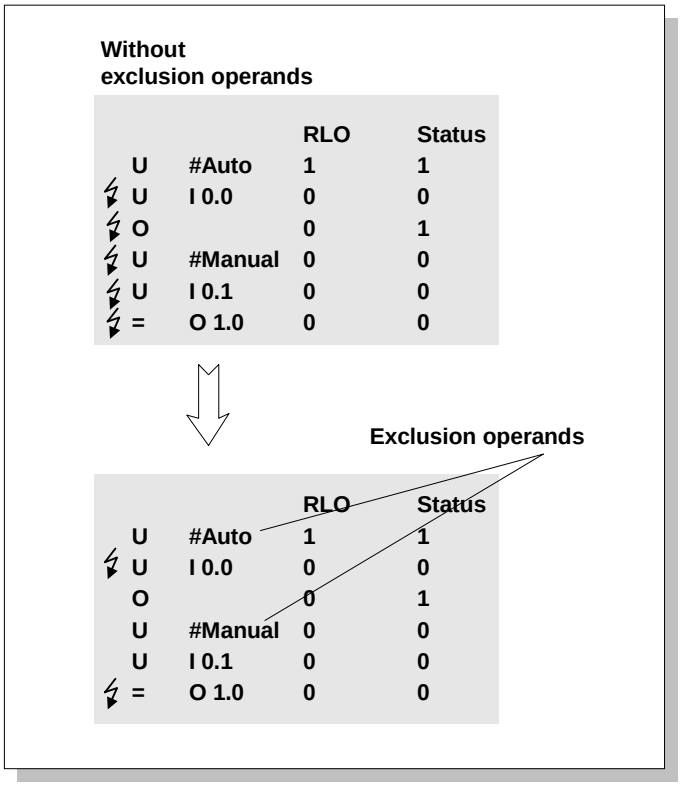
The criteria analysis treats all operands equally. This might result in subnetworks being identified as faulty that are jointly responsible for the error, strictly according to the logic, but being capable of exclusion as the cause of the error with the help of additional knowledge.

One example is the different system operating modes which, by definition, can never occur simultaneously on a unit, or individual operands for different product versions which similarly cannot be produced simultaneously.

For this reason S7-PDIAG features the option of defining **"exclusion operands"** on a list. ProAgent then only marks signals on a network as faulty on which the exclusion operand is detected with a value not equal to "0".

Example

The following example illustrates operand monitoring from A 1.0 to "0" status with the two operating modes "Auto" and "Manual":



Example of Exclusion Operands

From a strictly logical point of view, the marking of the faulty lines in the upper section of the program is correct. The subnetwork, which "Manual" mode is handling, is not causing an error by definition since the system is already in "Auto" mode and cannot be in another mode simultaneously.

By taking this additional knowledge into account, the substantially clearer error identification results in the lower section of the program.

Display by ProAgent

As a result of definition of the exclusion operands, fewer lines are identified as causing the error.

This key is used to toggle between full and partial view (see Toggling Between Partial and Full View):

- With non-partial display, all the lines are still visible, but fewer lines are marked with the *lightning flash* symbol as causing the error.
- Correspondingly fewer lines are displayed at partial view.

In either case, transparency is far greater and analysis is facilitated.

Configuring in ProTool

6

Overview

This chapter shows you in detail how you incorporate a process diagnosis in a new project or how you can upgrade an existing project to include process diagnosis.

6.1 Configuring a Process Diagnosis

6.1.1 Basic Requirements of the PLC Program

In order to configure a process diagnosis, both the PLC and the operating unit must be configured. ProTool and ProAgent can only be used for configuring the operating unit.

As a basic requirement, ProTool plus ProAgent requires a diagnosable PLC program.

Programming Language

The PLC is programmed either in STEP 7 (STL or LAD) or in S7-GRAPH.

- If you are using LAD/CSF/STL, you will need the S7-PDIAG options pack. S7-PDIAG allows you to extend the PLC program so that individual signals such as for the status of inputs, outputs, markers etc. are monitored.
- If you are using S7-GRAPH, the PLC programs are automatically diagnosable without having to use an additional options pack. The currently active steps are always monitored. Monitoring functions are available across the whole sequence and are integrated in the sequence blocks.

  Only if you wish to trigger movements for S7-GRAPH units will you need the S7-PDIAG options pack as well.

The procedure for programming the PLC and the particular aspects to be considered when doing so are explained in the documentation for S7-PDIAG and/or S7-GRAPH.

Points to Bear in Mind

The PLC program must work correctly.

When working with S7-PDIAG make sure that

- the fault detection FB is invoked in OB1
- the program contains no loops, as the fault detection FB is invoked only once per cycle
- fault detection has been activated for the individual fault monitoring routines
- initial value detection has been activated for the individual monitoring routines if you want to use the Detail Screen
- the UDT Movement has been used if you want to use the Movement Screen The UDT Movement creates a standardized interface with the Movement Screen.

Always make sure that

- if you are working with more than one language, that the languages to be selected and configured in ProTool have definitely been configured in the PLC program
- if you are working in one language only, that the same language has been used in the PLC program as is to be used to configure the operating unit
- the PLC program has been translated

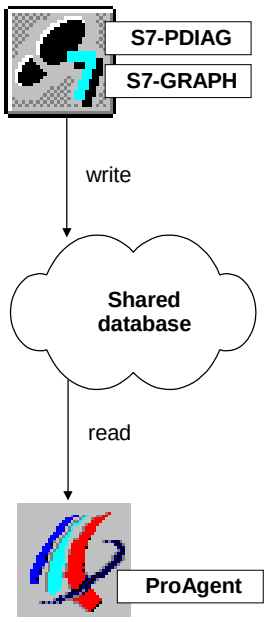
Message Text

As part of the process of programming the PLC you define the text of messages that will subsequently appear on the operating unit as alarm messages. In other words, the text of diagnosable messages is **not** entered in the Message Editor in ProTool as would normally be the case, but in STEP 7.

6.1.2 Shared Database with STEP 7

Accessing the Database

STEP 7 and its option packages store all the data required for the process diagnosis in a shared database.



Shared Database

ProTool accesses the required information about the PLCs present from that database, i.e.

- which units are diagnosable
- which signals are monitored for which statuses
- which display classes have been defined
- which message texts have been defined

Updating the Database

The database is always updated whenever a monitoring block is retranslated in STEP 7. You must be take account of this relationship.

Note
The database is not updated if you make changes in STEP 7 without subsequently retranslating the monitoring blocks. ProTool will then not have access to the latest data!

Content Requirements

At certain times, ProTool places specific "minimum requirements" on the data stored in the database.

It is always preferable, of course, if the PLC program is already complete and fully tested. In practice, however, this will not always be the case and you may want to be working on the PLC program and the operating unit configuration at the same time.

The table below shows which data is absolutely necessary at which point. A description of the individual stages in the process is provided in the chapter *Overview of the Configuration Steps in ProTool (Chapter 6.1.3)*.

Configuration Stage	Requirements
Incorporating the diagnosis screens	System plan (ProTool/STEP 7)
Linking the Diagnosis Screens	System plan (ProTool/STEP 7)
Selecting the Units	Definition of monitoring routines (STEP 7) Translated monitoring blocks (STEP 7)
Selecting the display classes	Message configuration (STEP 7)
Compiling and Downloading	Final translated PLC program (STEP 7)

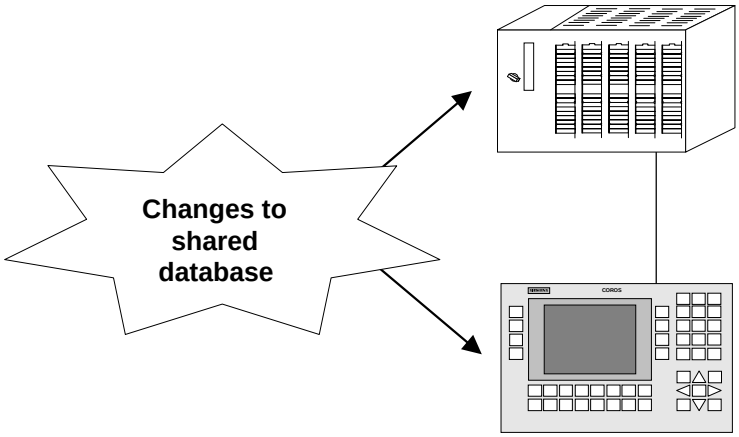
Minimum Database Requirements

Consistency of Data

PLCs and operating units exchange data during operation but not their programs. As the programmer, you are responsible for ensuring that the latest version of the relevant program is used on each device.

If, therefore, changes are made to the PLC program at some later date, you must also recompile and re-download the operating unit configuration so that there are no inconsistencies between devices.

When compiling the operating unit configuration, the stored messages and diagnosis data are imported from the database shared with STEP 7.



Interdependencies

Activating Data Synchronization

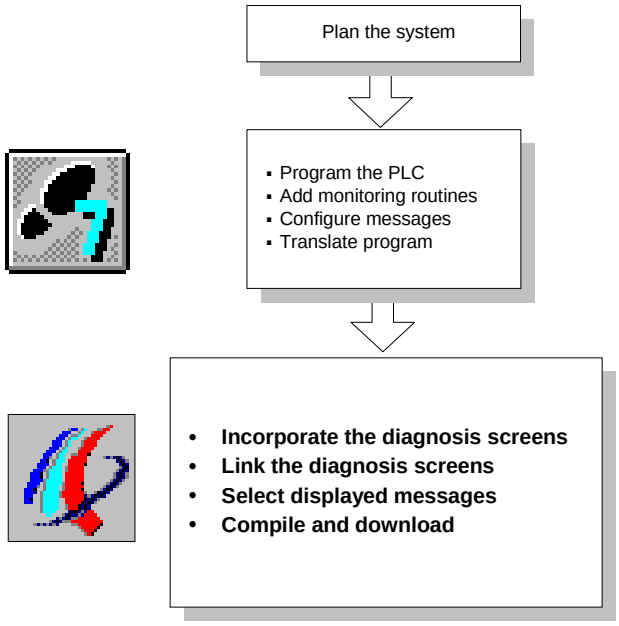
By choosing *File* → *Settings* → *Compile* you can select which data in the database shared with STEP 7 is to be synchronized, i.e. re-imported if necessary when compiling. Normally synchronization with the complete database should remain selected. In that case you can be sure that the most up-to-date data is always made available to the operating unit.

In order to speed up the compilation process or if you deliberately wish to continue working with old STEP 7 data, you can deactivate synchronization (Compilation Settings dialog box). In that case, however, you are responsible yourself for ensuring that the compiled data is kept up to date as required.

6.1.3 Overview of Configuration Steps in ProTool

Overview

The diagram below shows the chronological sequence of all steps to be completed when configuring a process diagnosis.



Configuration Steps for Process Diagnosis

Tip
A special breakdown of the steps required when upgrading an existing configuration is given in the chapter Overview of the Steps Required When Upgrading (Chapter 6.2.2).

Requirements of the PLC Program

As universal system tools, ProTool and ProAgent are closely compatible with the STEP 7 software.

A breakdown of the minimum requirements to be satisfied by the PLC program is given in the chapter *Requirements of the PLC Program (Chapter 6.1.1)*.

In order that you do not have to define the same data more than once, the system uses a common database as an interface. As a general rule, therefore, the PLC program should already exist and have been translated before you start working in ProTool.

A list of which steps should have been completed in STEP 7 at what point is given in the chapter *Shared Database with STEP 7 (Chapter 6.1.2)*.

Configuration Steps in ProTool

The process of configuration in ProTool requires only a few operations as follows:

1. Incorporating the Diagnosis Screens

   To begin with you import the supplied standard diagnosis screens into your project. You can copy them simply by the Drag & Drop method or via the Clipboard.

   If you are using S7-GRAPH units in your project and would like to see the step names of the units displayed on the overview screen, replace overview screen ZP_UNITS with the alternative overview screen ZP_UNITS_S7G (refer to *Replacing the overview screen (Chapter 6.1.9)*).

   Note:
   Note that the PLC name of the ProAgent project has to be identical with one of the PLC names in the destination project. If necessary, modify one the names accordingly.

2. Linking the Diagnosis Screens

   In order to be able to activate the diagnosis screens once they have been incorporated, you must assign one or more keys the appropriate screen selection function(s).

3. Selecting the Units

   This next step involves selecting the units of your system for which you wish to be able to carry out a process diagnosis. You will receive detailed information for these units only.

4. Selecting the display classes

   Finally, you can restrict the display of fault messages to specific display classes.

5. Compiling and Downloading

   Once configuration is complete, compilation and transfer to the operating unit is carried out as usual.

6.1.4 Incorporating the Diagnosis Screens

An OP or TP is an operating and monitoring device. Its central function, therefore, is to provide the user with an easy-to-use interface by means of which it is possible to identify process faults at a glance and rectify them quickly.

Ready-Made Diagnosis Screens

When ProAgent is installed, ready-made diagnosis screens for the various types of operating unit are stored in the appropriately named STEP 7 projects. They need only to be incorporated into your configuration in order to be ready for use.

Project name	Suitable for the devices
ProAgent 25	OP25, OP27 monochrome, C7-626
ProAgent 27	OP27 color
ProAgent 35	OP35 monochrome
ProAgent 37	OP37, OP35 color
ProAgent TP27-6 bw	TP27-6 monochrome
ProAgent TP27-6	TP27-6 color
ProAgent TP27-10	TP27-10 color
ProAgent TP37	TP37 color

Names of projects

Since ProAgent is used in many different countries around the world, the standard diagnosis screens supplied have been given English names as follows:

Name	Diagnosis Screen
ZP_PROAGENT	Diagnosis Start Screen
ZP_ALARM	Message Screen
ZP_UNITS	Overview Screen
ZP_UNITS_S7G	Alternative overview screen for S7-GRAPH
ZP_DETAILSYM	Detail Screen (signal list format)
ZP_DETAILAWL	Detail Screen (STL display mode)
ZP_DETAILLAD	Detail Screen (LAD display mode)
ZP_MOTION	Movement Screen
ZP_STEP	Step Screen

Names of the Diagnosis Screens

Caution
Only adopt the diagnosis screens in your project if you actually want to be able to carry out process diagnoses. When the diagnosis screens are downloaded to the operating unit, the full range of diagnosis functions is automatically downloaded as well. This will use up system resources even if you do not use those functions at all.

Easy to Adapt

It goes without saying that you can also modify or add to the diagnosis screens supplied and thus seamlessly integrate them in your systems. You will find essential information about how to do so in the chapter *Modifying the Diagnosis Screens (Chapter 8)*.

Integrated Operation

Note
ProAgent requires that ProTool has been installed integral with STEP 7. If you have only been using ProTool as a stand-alone product up to now, please first consult your *ProTool User's Guide* for details of working with integrated operation.

Step One

ProTool Standard Project

If you would like to create a new, diagnosable project, proceed exactly as you would with a ProTool project. You begin by opening one of the standard projects supplied. To do this, select the corresponding option box in the project wizard, and the standard screens are integrated automatically.

A precise description can be found in the User's Guide entitled *Configuring ProTool Graphics Displays*.

Step Two

Deactivating the Fixed Window

In the ProTool standard project, the fixed window is activated. However, this moves essential elements of the diagnosis screens and must therefore be disabled. It may be necessary to move the contents of the Fixed Window to one or more other screens.

To deactivate the fixed window proceed as follows:

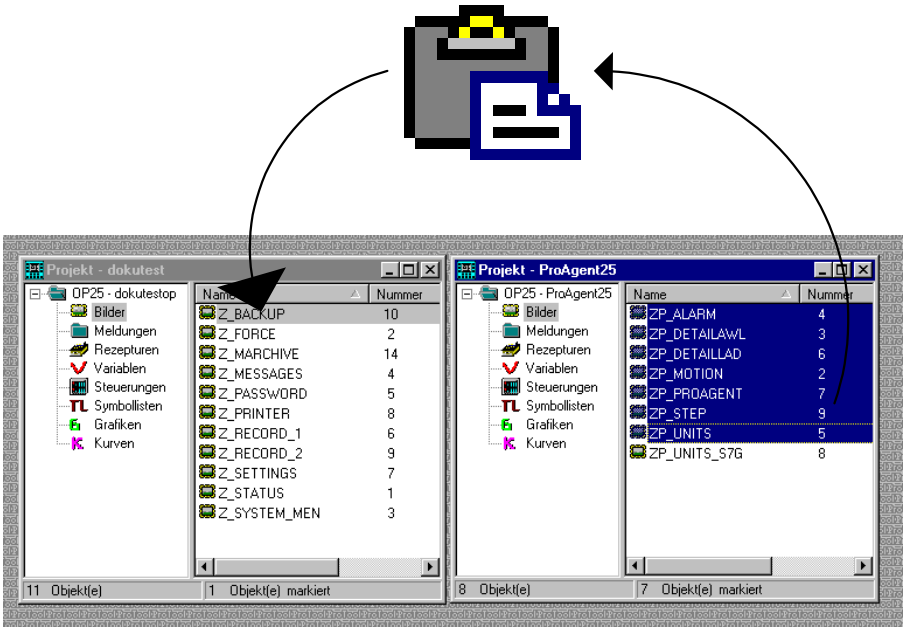
1. In ProTool, choose *System* → *Screen/Keys* and deselect the box next to *Fixed Window*.
2. If you do not wish to deactivate the Message Indicator as well, you should drag it with the mouse to the top right corner.

Step Three

Copying the Diagnosis Screens

Your project now contains the normal standard screens but as yet no diagnosis screens. The diagnosis screens for the various types of operating unit are all located in the STEP 7 project `ProAgent` which is automatically created in the ProTool directory in the subdirectory `PROAGENT\STANDARD` when ProAgent is installed.

This next step now involves copying the diagnosis screens you require from that project to your own project via the Clipboard.



Copying the Diagnosis Screens via the Clipboard

To copy the diagnosis screens from the STEP 7 project `ProAgent` to you own project, proceed as follows:

1. If you have not already done so, open your STEP 7 project and the operating unit project to which you want to copy the diagnosis screens.
2. Also open the STEP 7 project `ProAgent` and the operating unit project that corresponds to the operating unit being configured (e.g. `ProAgent25` for an OP25).
3. Select the *Screens* object type in the left column of the project window.
4. In the right column, select the screen or screens that you want to copy. You can select more than one screen at once by holding down the CTRL key.

   Generally speaking, you should copy all screens - but only one version of the overview screen, meaning either ZP_UNITS **or** ZP_UNITS_S7G. If you use the alternative overview screen - ZP_UNITS_S7G - take into account the notes contained in the chapter called *Replacing the Overview Screen (Chapter 6.1.9)*.
5. To copy the selected screens to the Clipboard, choose *Edit → Copy*. This process may take a little while depending on the performance of your computer and how busy it is.
6. Switch to the project to which you want to copy the diagnosis screens.
7. Select the *Screens* object type in the left column of the project window.
8. Insert the contents of the Clipboard by choosing *Edit → Paste* from the menu.

The diagnosis screens are now available for use in your project. All the necessary functions and tags have been copied along with the screens.

Remark
*It is **not** sufficient to open a screen and merely copy some or all of the screen contents. In order to ensure that full diagnosis capability is obtained, you need the complete screen including all tags and functions.*
*Essential information such as key assignment and functions configured for screen selection are **not** included when individual screen elements are copied.*
If you do not require all the information contained within a diagnosis screen, you should nevertheless still copy the complete screen to begin with. You can then delete individual screen elements or add new ones afterwards. When doing so, make sure that you also observe the guidance notes given in the chapter Modifying the Diagnosis Screens (Chapter 8).

Step Four

Checking the Target Positions

You only need to change the number of target positions on the Movement Screen (ZP_MOTION) if your PLC supports movements and defines more than 8 target positions per movement (see *Changing the Number of Target Positions (Movement Screen) (Chapter 8.4.7)*).

Continuing Configuration

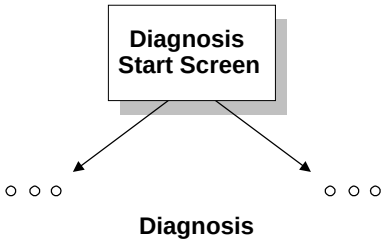
You can now continue with the process of configuration as normal. But do not forget to configure a screen change to the new diagnosis screens - and back again (refer to *Linking the Diagnosis Screens (Chapter 6.1.5)*).

6.1.5 Linking the Diagnosis Screens

Once you have incorporated the diagnosis screen (see *Incorporating the Diagnosis Screens (Chapter 6.1.4)*), you must make them accessible to the operator. You must therefore assign at least key the function of selecting a diagnosis screen, or you must make one of the diagnosis screens the start screen.

Using Only the Diagnosis Screens

The simplest approach is for your project to use only the diagnosis screens.



Use of Diagnosis Screens Only

The diagnosis screens are already linked with one another (see *How the Diagnosis Screens Are Linked to One Another (Chapter 5.1.3)*).

All you have to do is to make the Diagnosis Start Screen the start screen of your project as follows:

1. Select the *Screens* object type in the ProTool project window.
2. Click the object ZP_PROAGENT with the right mouse button. This is the Diagnosis Start Screen.
3. Choose *Properties* from the shortcut menu.
4. On the *General* tab in the dialog box that opens, select the *Start Screen* check box.

The Diagnosis Start Screen will then be displayed automatically when the operating unit is switched on. And from that point you can access all the other diagnosis screens one after the other by means of keys.

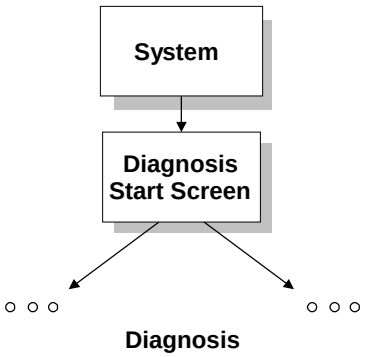
Activating the Diagnosis Start Screen

Normally, your project will contain other system-specific screens in addition to the diagnosis screens. In such cases, it is useful to make one of those screens the start screen or to create a general start screen.

From that point you can then control your system in the normal way. In addition, you configure a key which can be used to start the diagnosis package as you would a subroutine. The key in question activates the Diagnosis Start Screen from where you can then access all other diagnosis screens.

Advantage: the project is very easy to create and maintain. Operation is largely separate from operation of the system.

Disadvantage: the "indirect route" to the diagnosis functions via the Diagnosis Start Screen is not as straightforward from the operator's point of view as direct selection of the diagnosis screens.



Access to Diagnosis Functions via Diagnosis Start Screen

To configure a screen selection function for the Diagnosis Start Screen, proceed as follows:

1. Configure the function `Select Screen` and assign it to a key.
2. As the function parameter select ZP_PROAGENT.

When, subsequently, the key concerned is pressed, it opens the Diagnosis Start Screen from where all other diagnosis screens can be accessed by means of keys.

You must also make sure that you provide a means of returning from the Diagnosis Start Screen (ZP_PROAGENT) to your own screens. To do so, you should assign at least one key an appropriate screen selection function. You can use the symbol ZP_ESC as the pictogram.

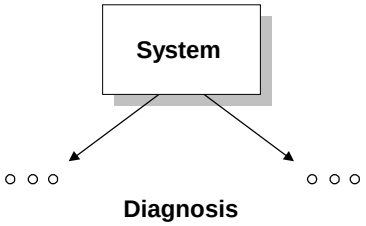
Caution
Do **not** use the `Select Previous Screen` function. As this function only goes one step back and does not have a stack, there is a risk of getting stuck in an endless loop.

Moving Directly to the Diagnosis Screens

You can also bypass the Diagnosis Start Screen by activating the Message Screen or the Overview Screen directly from any other screen in your configuration.

You can then move from the Message Screen or Overview Screen to the Detail Screen or Movement Screen.

You can also activate the Detail Screen and the Movement Screen from any other system screen but in that case, a diagnosable message must have been selected in the Message Window or the Message Line.



Direct Access to Individual Diagnosis Screens

Caution
In the case of a direct call from your own system screens, specific functions have to be executed prior to changing screens. Omission of those functions will result in errors in the process of constructing the diagnosis screens.

To access the Message Screen or the Overview Screen from any of the screens in your project, proceed as follows:

1. If you wish to assign the function to a soft key, open the screen from which you wish to be able to access one of the diagnosis screens.

   If you wish to assign the function to a function key, choose the menu option *System* → *Screen/Keys*.

   If you wish to assign a button on a TP, create this button under the menu item *Paste* → *Button*.
2. Click the key that is to be used for selecting the screen.
3. Configure the function `ProAgent: Analyze Faults` as the first function. This function **must** be executed before the screen is selected. As the event, use the default setting (Press Key). No parameters are required.
4. Next configure the function `Select Screen`. Here too, you should use the default setting (Press Key) as the result. Specify the following parameters:
   - the screen name ZP_ALARM if you wish to activate the Message Screen
   - the screen name ZP_UNITS if you want to activate the Overview Screen
5. Finally, confirm your entries by choosing *OK*.

The diagnosis screen concerned can now by accessed directly using the key configured.

If you access the Message Screen or the Overview Screen directly rather than via the Diagnosis Start Screen, you doubtless want the Previous Screen key to take you back to the last screen you were on rather than to the Diagnosis Start Screen.

On the standard diagnosis screens supplied, this key is assigned the function `Select Screen` with the parameter ZP_PROAGENT. Change that parameter accordingly so that your own "start screen" is selected.

Caution
Do **not** use the `Select Previous Screen` function. As this function only goes one step back and does not have a stack, there is a risk of getting stuck in an endless loop.

6.1.6 Selecting the Units

Clarity through Careful Selection

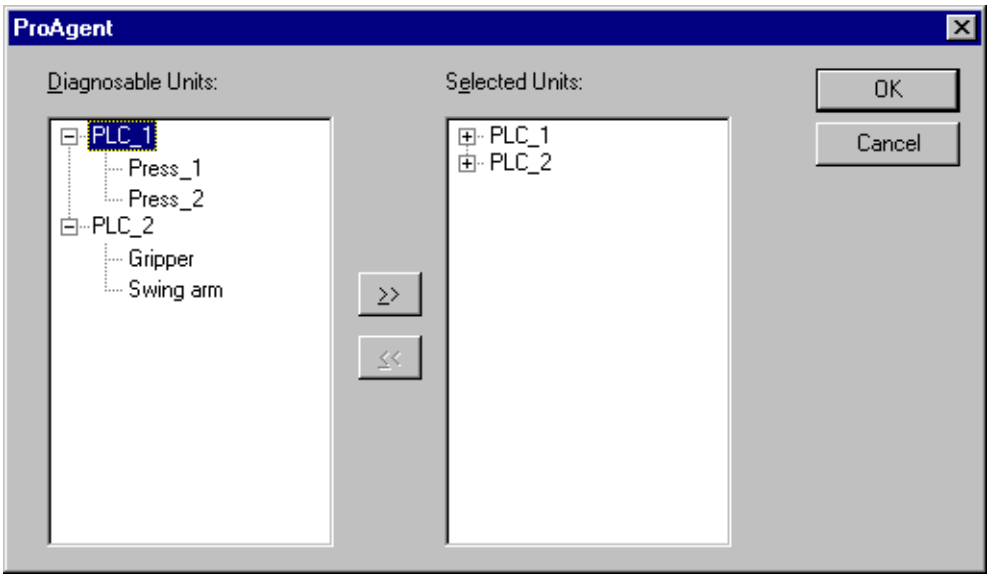
In ProTool you can define specifically which PLCs and units you want to monitor from a particular operating unit. It may be, for example, that your system has more than one operating unit. In that case, you would naturally only want to carry out diagnoses on each operating unit for the units actually operated by the operating unit in question.

Note
Only ever monitor one unit at a time from one operating unit, otherwise the operating units could block each other when you trigger movements from the Movement Screen.

As well as or instead of the selection of messages by units, you can also make the display of messages dependent on the *display class (Chapter B)* that has been assigned to the message in STEP 7.

System → ProAgent

You specify the units that are to be included in the process diagnosis by choosing the menu option *System → ProAgent*. A two-column selection box allows you to specify the units you want to include.



Units for Diagnosis

Only those units are offered for selection that are actually diagnosable, i.e. that have been programmed accordingly in S7-PDIAG or S7-GRAPH.

The tree structure shown corresponds to the hierarchy that results from the PLC program concerned.

Only the messages of the units selected here will be displayed on the operating unit.

Note
The necessary information is obtained by ProTool from the database shared with STEP 7. If you can't find a particular diagnosable unit you are looking for on the list, recompile the PLC program (see *Shared Database with STEP 7 (Chapter 6.1.2)*). If you change the name of a PLC, that name will be displayed instead of the name used in STEP 7.

Adding Units

To select a unit for diagnosis proceed as follows:

1. In the *Diagnosable Units* box, select the unit you wish to include in the diagnosis.

   By clicking *+* or *–* you can view or hide information on the individual blocks of the PLCs.

2. Click the *>>* button.

The unit selected then appears in the list of selected units. This unit can then be diagnosed during operation, i. e. messages that concern the units will be displayed on the operating unit.

Note
Only select units for diagnosis if you are actually going to use the diagnosis functions, i.e. if you want to configure a Diagnosis Screen or use ProAgent functions Otherwise you will be using system resources on the operating unit unnecessarily.

Removing Units

To remove a unit from the list of selected units proceed as follows:

1. In the *Selected Units* box, select the unit you wish to remove.
2. Click the *<<* button.

The unit selected then disappears from the list of selected units. Process diagnosis can then **not** be performed on that unit during operation.

6.1.7 Selecting the display classes

ALARM_S Message Procedure

The process diagnosis requires the ALARM_S Message Procedure. Only units that use ALARM_S can be diagnosed.

Detailed information about ALARM_S is provided in the chapter *Message Processing (Chapter 7)*.

If you use ProAgent, the Alarm_S message procedure is preset in ProTool.

Note
You can use ALARM_S with the message bit procedure. If you have selected only ALARM_S as the message system for a project in ProTool, the *Editors* window no longer offers the event and alarm messages options.

Once the *ALARM_S* message procedure is activated, all messages are automatically displayed on the operating unit.

If you don't want this, you can set in ProTool the messages from which units and which display classes to be displayed at the operating unit.

The *display classes (Chapter 7.2)* were defined when programming the PLC in STEP 7. This involves specifying for each message the display class to which it belongs.

You will normally limit the number of messages by selecting the units. You can restrict the messages displayed on the operating unit to very specific messages by targeted selection of specific display classes.

As well as the selection of messages by display classes, you will also normally make the selection of messages dependent on the *unit (Chapter 6.1.6)* from which the message originates.

Selecting Display Classes

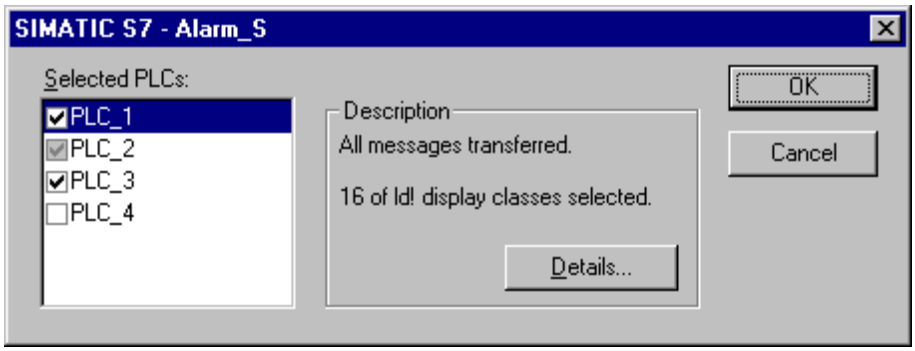
1. Choose the menu option *System* → *Messages* → *Settings*.

   The Message Settings dialog box opens.

Dialog box *Message Settings*

2. Press the command button *Alarm_S* to select specific display classes.

The dialog box *SIMATIC S7 Messages* opens. The left hand side of the dialog box shows a list of all the PLCs in your system.



Dialog box *SIMATIC S7 Messages*

3. For every PLC specify what messages should be displayed on the operating unit:

- In order not to display messages on the operating unit, deselect the check box on the left next to the PLC.
- In order to display all messages on the operating unit, select the check box on the left next to the PLC.
- To have only a selection of messages of specific display classes displayed on the operating unit, select the desired PLC, click the button *Details* and then make your selections in the *Display Classes* dialog box. The check box to the left of the name of the PLC then appears with a gray background.

  During operation of the system, only those messages that belong to a selected display class will then appear on the operating unit.

6.1.8 Compiling and Downloading

Familiar Sequence

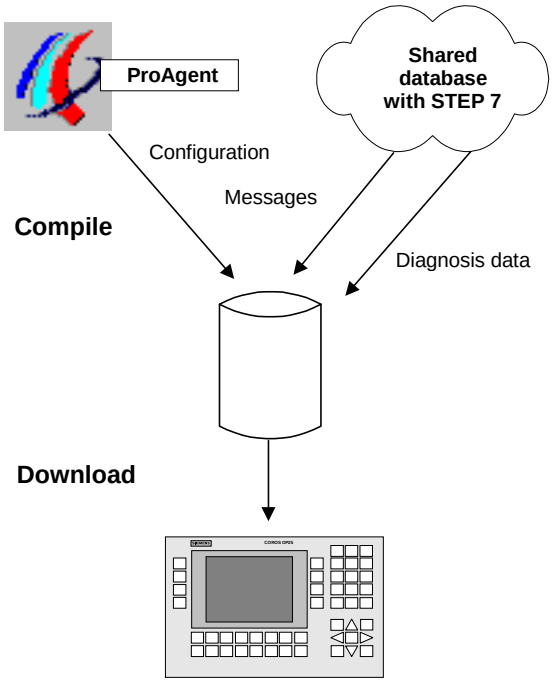
Compiling and downloading the finished project is done in exactly the same way as you are familiar with from ProTool. The process diagnosis configuration is checked at the same time as the general consistency checks are carried out.

Tip
Help on the relevant error messages can be obtained by positioning the cursor on the line with the message concerned and pressing F1.

Access to the Shared Database

During the process of compilation, ProTool accesses the database shared with STEP 7 and imports from it the message texts defined in STEP 7 as well as all diagnosis data required.

The message texts and the data are then downloaded to the operating unit together with the remaining project data.



Compiling and Downloading

Note
Before starting the compilation process, make sure that the database is up to date. If you have made any alterations in STEP 7, retranslate the blocks concerned. The process of translation updates the database at the same time (see *Shared Database with STEP 7 (Chapter 6.1.2)*).
Data is only imported from the shared database if synchronization has **not** been deactivated in ProTool under *File* → *Settings* → *Compile*.

Proceed As Follows

To compile and transfer the finished project, do the following:

1. Make sure that under menu option *File* → *Settings* → *Compile* all options are selected (this is not absolutely necessary if no changes have been made in a particular category since the last compilation run).
2. Choose the menu option *File* → *Compile* as normal in ProTool.
3. As normal in ProTool, choose the menu option *File* → *Download*.

The diagnosis-compatible project is now on the operating unit.

6.1.9 Replacing the Overview Screen

Alternative Overview Screen

If you are using your system with units programmed in S7-GRAPH, you can replace, if you wish, the normal Overview Screen with the Alternative Overview Screen for S7-GRAPH. On it you can see the step names associated with the different units.

Procedure

In order to replace the standard overview screen, ZP_UNITS, with the alternative overview screen, ZP_UNITS_S7G, perform the following steps:

1. If not already available, copy screen ZP_UNITS_S7G to your project from the STEP 7 `ProAgent` project (subdirectory called `PROAGENT\STANDARD`).
2. On the screens ZP_PROAGENT and ZP_ALARM, modify the screen selected by the Overview Screen key from ZP_UNITS to ZP_UNITS_S7G.
3. Since there are fewer lines available on the alternative overview screen for S7-GRAPH than on the standard overview screen, you have to change the start value of the ZP_UROWS tag (background information on the significance of this type of start value can be found in the chapter called *Modifying Diagnosis Screens (Chapter 8)*.

   Select the *Tags* object type in the project window and right-click on the ZP_UROWS tag.

   Choose the *Properties* option from the shortcut menu and change the start value in the dialog box that opens on the *Options* tab in the following manner:

   OP25, OP27, C7-626, TP27–6: Start value = 3

   OP35, OP37, TP27–10, TP37: Start value = 8
4. Delete the ZP_UNITS screen.

6.1.10 Porting onto Computers without STEP 7

Computers without STEP 7

It may be that you have only installed ProTool plus ProAgent and STEP 7 on your workstation PC but would like to take a finished project to a machine location on a notebook or a PU.

Although all the data shared with STEP 7 is held in a common database (see *Shared Database with STEP 7 (Chapter 6.1.2)*) and ProTool plus ProAgent has to run integral with STEP 7, it is possible with certain limitations to open, to compile and to download to an operating unit existing ProTool configurations using ProTool as a stand-alone product.

This is possible since a working copy of all necessary data is stored internally in the ProTool project (PDB file).

Caution
When opening a configuration in ProTool as a stand-alone project, data is not synchronized with the shared database.

Limitations

All dialog boxes relevant to diagnosis functions can be selected in stand-alone operation but can not be edited.

Caution
You are responsible yourself for ensuring that data is synchronized with the shared database if any changes are subsequently made to the STEP 7 program.

Exporting a Project

To copy a ProTool project from a STEP 7 project to another computer, proceed as follows:

1. Start the SIMATIC Manager.
2. Open the STEP 7 project.
3. Select the operating unit whose project you want to copy.
4. Choose the menu option *Edit → Object Properties* and open the *OP Properties* dialog box.
5. Make a note of the path specified for *Configuration File* and the name of the file with the extension *.PDB. This is the project you are looking for.
6. Copy the file (using the Windows Explorer, for example) to the computer and directory of your choice.

You can now open the project on the destination computer using ProTool alone. If you make any changes, you can subsequently reintegrate the project (see *ProTool User's Guide*).

6.2 Special Considerations When Upgrading an Existing Project

6.2.1 Requirements of PLC Program and Project when Upgrading

PLC Program

As a basic requirement, ProTool plus ProAgent requires a diagnosable PLC program. And the same is true whether you are creating a new project or upgrading an existing project to include process diagnosis.

An overview of the basic requirements is given under the heading Basic Requirements of the PLC Program in the chapter *Configuring a Process Diagnosis (Chapter 6.1)*.

Project

There are no particular requirements placed on the project being upgraded.

On basic requirement, however, is that the operating unit configured is diagnosable, that is, an OP25, OP27, C7-626, TP27-6, TP27-10, OP35, OP37 or TP37.

Your project can include more than one PLC including ones which do not meet the requirements for process diagnosis. In that case, however, those PLCs will not be capable of diagnosis.

You can also integrate various different diagnosable PLCs in your project and even program them in different languages according to the particular requirements – e.g. one PLC in STL using S7-PDIAG and another in S7-GRAPH.

Fixed Window

The diagnosis screens require the whole of the operating unit screen area. If your project uses the Fixed Window, it will hide important parts of the diagnosis screens and prevent you from using some of the diagnosis screen functions. For that reason, you should deactivate the Fixed Window and move its contents to another screen. Alternatively, you can modify the diagnosis screen accordingly (see *Modifying the Diagnosis Screens (Chapter 8)*.

Uniform Design

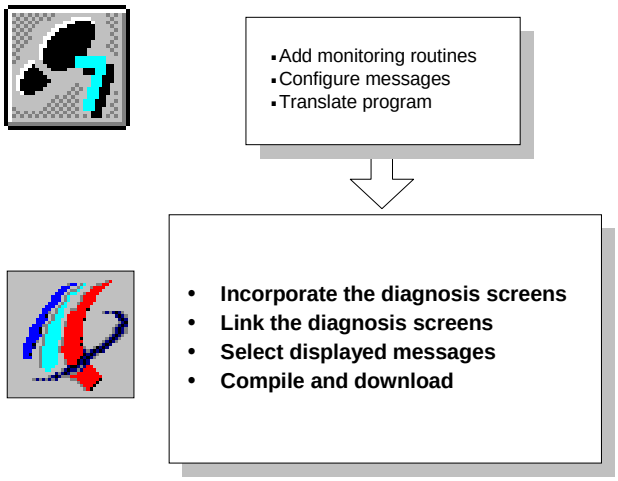
Information on how you can modify the diagnosis screens so that they are visually in harmony with the rest of your system configuration is also given in the chapter *Modifying the Diagnosis Screens (Chapter 8*.

6.2.2 Overview of the Steps Required when Upgrading

Overview

Upgrading an existing project to include process diagnosis is not significantly different from the process of creating a new project with diagnosis capability.

The diagram below shows the steps required in chronological order:



Configuration Steps Involved in Upgrading a Configuration to Include Process Diagnosis

Tip
*A special breakdown of the steps required when **creating** a new project with diagnosis capability is given in the chapter* Overview of Configuration Steps in ProTool (Chapter 6.1.3)*.*

Requirements of the PLC Program

As universal system tools, ProTool and ProAgent are closely compatible with the STEP 7 software.

A breakdown of the minimum requirements to be satisfied by the PLC program in order that you can define a process diagnosis in ProTool is given in the chapter *Requirements of the PLC Program and the Project when Upgrading (Chapter 6.2.1)*.

In order that you do not have to define the same data more than once, the system uses a common database as an interface. As a general rule, therefore, the PLC program should already exist and have been translated before you start working in ProTool.

A list of which steps should have been completed in STEP 7 at what point is given in the chapter *Shared Database with STEP 7 (Chapter 6.1.2)*.

Configuration Steps in ProTool

The process of configuration in ProTool requires only a few operations as follows. A detailed description of the individual steps is given in the chapter *Configuring a Process Diagnosis (Chapter 6.1)*.

The list below outlines the special considerations when upgrading an existing project.

1. Incorporating the Diagnosis Screens

   To begin with you copy the supplied standard diagnosis screens into your project. This can be done easily via the Clipboard.

2. Linking the Diagnosis Screens

   You have to create a means of accessing the diagnosis screens from the existing screens. Normally, a function for selecting the Diagnosis Start Screen is entirely adequate.

   Conversely, you must provide a means of returning from the diagnosis screens to your own screens. The simplest way of doing this is to configure an appropriate screen selection function on the Diagnosis Start Screen.

The remaining steps are the same as for creating a new project, i.e.:

3. Selecting the Units

4. Selecting the display classes

   You can use ALARM_S alongside the message bit procedure if your existing project still uses the message bit procedure.

5. Compiling and Downloading

Special Considerations

The Message Screen can only be selected by means of the `Select Screen` function. The functions `Change EM Page/Buffer` and `Change AM Page/Buffer` should no longer be used.

Since the extended functions provided by the diagnosis Message Screen offer considerably more powerful capabilities in any case, it is better to use the diagnosis Message Screen in the first place.

You should modify the configuration of your keys accordingly.

6.2.3 Upgrading Existing Projects to New Diagnosis Screens

The latest version of ProAgent also contains new standard diagnosis screens for which new ProAgent functions have been used during configuration. To ensure you have the full functionality at your disposal, you must use these new standard diagnosis screens in existing projects too.

There are essentially two ways to link your own screens in an existing project to the new standard screens instead of the old ones. Which of these ways is the better for you depends on the layout of your old project.

Upgrade for Projects with a Large Number of Global Settings

If your project contains a large number of global settings (e.g. for alarm messages, event messages or for printer parameterization) that you wish to retain, delete all the old standard screens, the tags and text or graphic lists. You recognize the elements that belong to diagnostics by the "ZP_" at the beginning of the name. Only once you have made these deletions are you able to copy the relevant new elements into your project.

1. Open you existing project.
2. To delete the screens, you have to release the existing links first. To do this, select the screen in question and call the menu item *View* → *Cross-reference*.

   The Cross-reference dialog window then displays all the links of the screen selected.
3. Double-click the first reference (element with an oval border). The screen in which the link is located opens. The element with which the standard screen is linked is marked.
4. Delete the link. Proceed in exactly the same way for the remaining cross-references and screens.
5. In the project window, select all the screens and delete them.
6. If necessary, delete for a second time any screens that may have not have been deleted first time round.
7. In the project window, delete all the tags of the standard screens. You recognize these by the "ZP_" at the beginning of the tag name.
8. Double-click the tags that cannot be deleted straight off.
9. In the *Tag* window, delete the function(s) that use the tag.
10. Delete all the tags that have been left in the project window.
11. Delete the text or graphic lists in the project window.
12. Copy the standard diagnosis screens of the new version of ProAgent to the project. The tags, functions and text or graphic lists required are copied in the process. Detailed instructions on how to copy screens can be found under *Integrating the Diagnosis Screens (Chapter 6.1.4)*.
13. Now remake the links between the new diagnosis screens and your project.

Upgrade for Projects with a Small Number of Global Settings

If you project contains only a small number of global settings, it is easier to merge your own old screens with the new diagnosis screens in a new project. The global settings (e.g. for alarm messages, event messages or for printer parameterization) of your old project are however lost in the process and have to be entered into the new project manually:

1. Create a new project under menu item *File* → *New*.
2. Assign the same PLC name as you have already used in the project you want to link to the new diagnosis screens.
3. Copy the standard diagnosis screens of the new version of ProAgent to the new project by means of drag & drop. Detailed instructions on how to copy screens can be found under *Integrating the Diagnosis Screens (Chapter 6.1.4)*.
4. Copy your own screens that you wish to continue to use from your old project to the new one. The old standard diagnosis screens are not copied over at the same time.

   The links between your own screens and the new diagnosis screens are now automatically correct.
5. Likewise per drag & drop, copy the messages that you wish to continue to use from your old project to the new one.
6. If you had made specific settings in your old project in the *System* menu, re-enter them now for your new project.
7. In the same way, you also have to re-enter any inputs you had made under *File* → *Project Info*.

You can now open the new standard diagnosis screens in your existing project.

6.2.4 Message Window and Message Screen

Standard Message Page

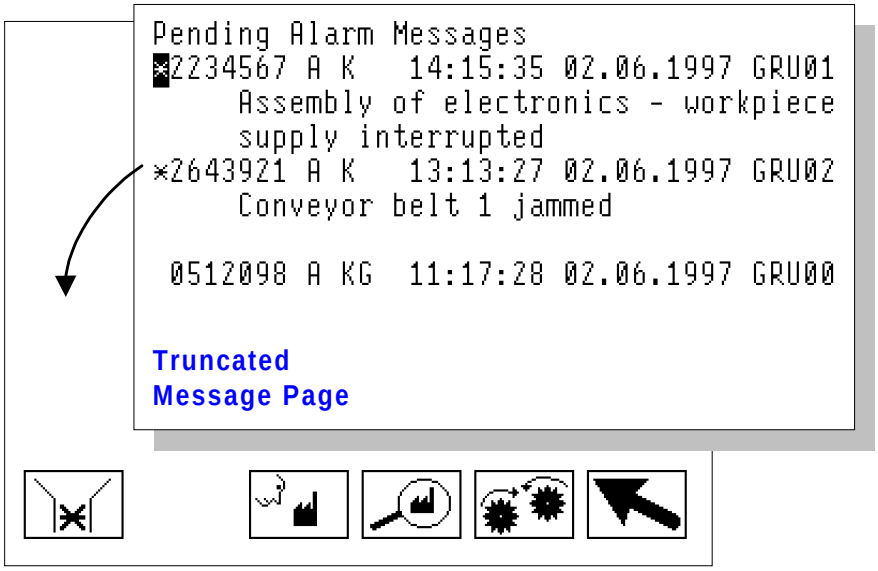
The diagnosis Message Screen makes use of the functions provided by the standard message page for the purposes of displaying messages.

The Message Page always occupies the whole of the screen and does not permit use of any keys. Accordingly, no pictograms can be displayed either.

In order to make it possible to do so for the purposes of diagnosis, the diagnosis Message Screen is made up of two superimposed screens, i.e.

- in the background the "blank" diagnosis Message Screen on which the relevant keys are configured
- from a truncated ProTool message page that is superimposed over the diagnosis Message Screen but leaves the keys visible.

The truncated Message Page is automatically displayed with the aid of the function `Display Messages` when the diagnosis Message Screen is selected.



Background screen: Diagnosis Message Screen

Layout of the Diagnosis Message Screen

If you create your own message screen, you must therefore configure the function `Display Messages` for screen selection.

Exiting the Message Screen

The ESC key is inactive. To simultaneously close the background screen and the truncated Message Page (i.e. the diagnosis Message Screen) you must select another screen.

Effects on ProTool

The truncated Message Page and full-size Message Page can not be used together in the same project. As soon as the `Display Messages` function opens the truncated message page at one or more locations, the truncated message page is always opened.

Tip
If the `Display Events` function or the `Display Alarms` function is configured outside the message screen, they do not react any more in the case of a diagnosable project. Therefore remove these functions from your project, if necessary.

Message Processing 7

Overview

This chapter provides detailed information about the message number procedure ALARM_S. It explains how ALARM_S differs from the message bit procedure and how the system behaves in the event of critical overloads.

7.1 Message Number Procedure ALARM_S

Why ALARM_S?

The STEP 7 option packages S7-PDIAG and S7-GRAPH only issue ALARM_S messages. For that reason, the message number procedure ALARM_S must be used for configuring process diagnosis in ProTool as well.

What is ALARM_S?

ALARM_S is a message number procedure. The message numbers are issued automatically during the configuration process in STEP 7. The numbers are used as the basis for assignment of the correct message text.

When a fault arises, the operating unit receives a message containing the message number. On the basis of the number, the corresponding message text is identified and displayed.

When a fault occurs, the CPU stores not only the status of the message (arrived, departed, acknowledged) but also the time. This enables precise diagnosis of the cause of the fault.

The message information is stored on the PLC and is not discarded immediately after issue of the message. This means that individual network components (e.g. the OP) can later log themselves on for Updating.

Advantages of ALARM_S

As compared with the message bit procedure, ALARM_S has the following advantages:

- ALARM_S is an active message procedure. When a message is issued, the CPU actively notifies all networked units. The operating unit is relieved of the task of continually polling the message area.
- The process data always precisely reflects the situation at the time of the message. This can not be guaranteed with the message bit procedure.
- The time stamp precisely indicates when an event occurred even if the operating unit is not connected until a later time.

Display Classes

The individual messages can be assigned different display classes in STEP 7. When configuring in ProTool, you then can then choose a specific selection of display classes for an operating unit. In that way you can distribute the messages selectively between different display units.

Priorities

You can assign the messages different priorities when configuring ALARM_S messages as well. The priorities are handled in precisely the same way as you are familiar with from the message bit procedure. For more precise details, please consult your ProTool documentation.

Tip
Make sure that you assign messages that can bring about consequential errors a higher priority than the consequential errors.

Tip
After additional configuration of a suitable filter on the message screen (refer to Defining filter criteria (message screen) (Chapter 8.4.8)*), you can filter messages below a given priority. The operator can then concentrate on the causal errors in the case of messages overload.*

Types of ALARM_S Message

Configuration of messages in STEP 7 involves two types of ALARM_S message. They differ in the way in which they are acknowledged.

- Alarm messages

  Alarm messages may or may not need to be acknowledged. Alarm messages are supported by diagnostics.

- Event messages

  Event messages normally do not need to be acknowledged. These messages are **not** supported by diagnostics.

Configuring ALARM_S Messages

ALARM_S messages are **not** configured in ProTool but in STEP 7 (see *Configuring ALARM_S Messages (Chapter 7.3)*). The advantage of this is that the messages are compiled centrally and only have to be created once.

7.2 Display Classes

What Are Display Classes?

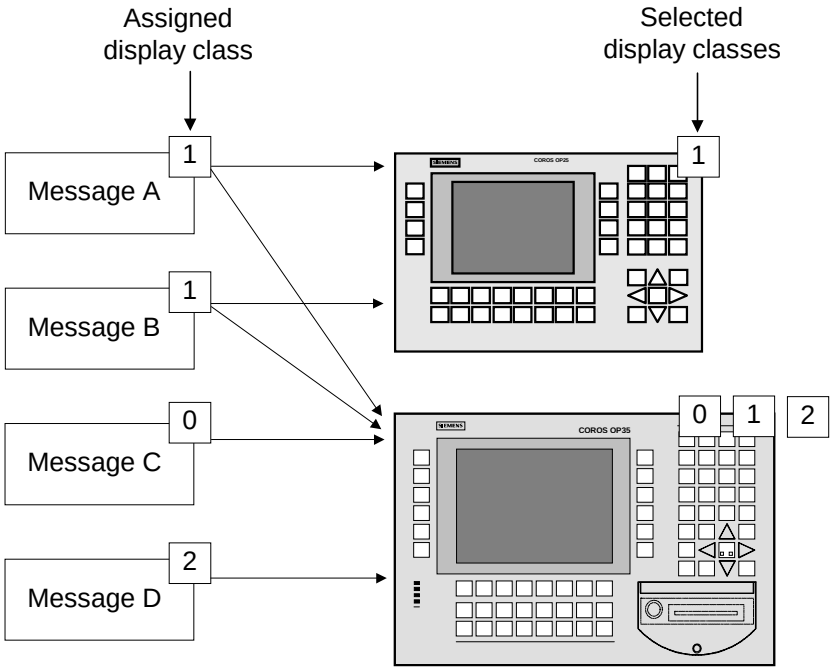
The CPU of a PLC always issues ALARM_S messages to all stations that are logged in. However, it may be that you do not want to display all messages on a particular operating unit – because there would be too many for the operator to deal with, for example. In that case, specific messages could be displayed only on a control desk, for example.

In order to be able to selectively control display of messages in that way in STEP 7 each message can be assigned what is termed a **Display Class**. In all, there are 16 display classes (display classes 0 to 15).

Example:

Messages that are to appear on the machine might be assigned display class 1, those that are to appear on the control desk, display class 2.

The various operating units then only analyze those messages that belong to specific display classes. Any other ALARM_S messages are immediately discarded.



Display Classes Determine which Groups of Messages are to be Displayed on the OP

Specifying Display Classes

The display class to which an ALARM_S message belongs is determined when the message is configured in STEP 7. For a precise description of the procedure, please consult the information on message configuration in your STEP 7 documentation.

If you do not specify a display class in STEP 7 the message concerned is automatically assigned to display class 0.

Selecting Display Classes

In ProTool you must specify which display classes are to be displayed on the operating unit being configured.

You make your selection by choosing *System → Messages → Settings*. You can find a detailed description in the chapter *Selecting the Display Classes (Chapter 6.1.7)*.

If you do not make a selection, all display classes (display classes 0 to 15) are displayed as the default.

7.3 Configuring ALARM_S Messages

Configuring Messages in STEP 7

ALARM_S messages are always configured in STEP 7 rather than in ProTool. The advantage of this is that you can use the messages on different display units but only have to enter them once.

When configuring messages in STEP 7 you can either enter simple unformatted text or make use of the facility for device-specific message configuration. Depending on the display unit in question, you can then specify such effects as flashing text and define additional information.

Detailed reference information on the individual dialog boxes is given in the STEP 7 Online Help. The sections which follow provide a brief overview of the general procedure.

General Procedure

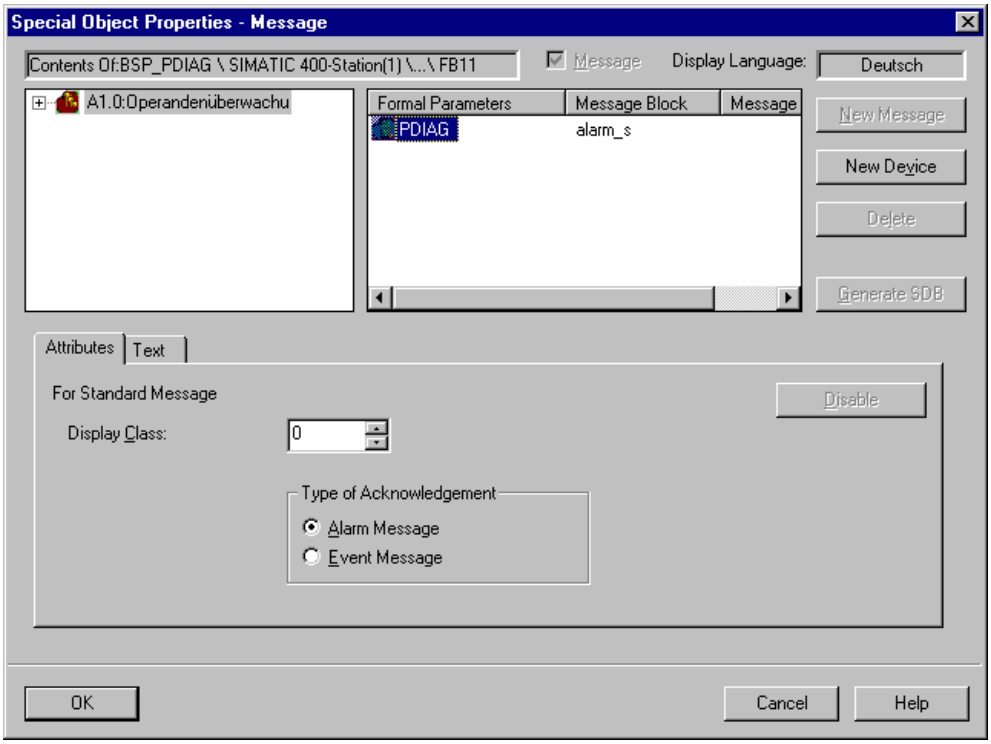
If, for example, you create an operand monitoring routine in S7-PDIAG, the following dialog box appears initially:

Configuring Simple Message Texts

If you have no special output requirements for the message, all you need to do is enter the message text in the *Text* box.

If, however, you wish to make use of the particular display capabilities of your operating unit, you can click the *Configure* button to define a display-specific message configuration.

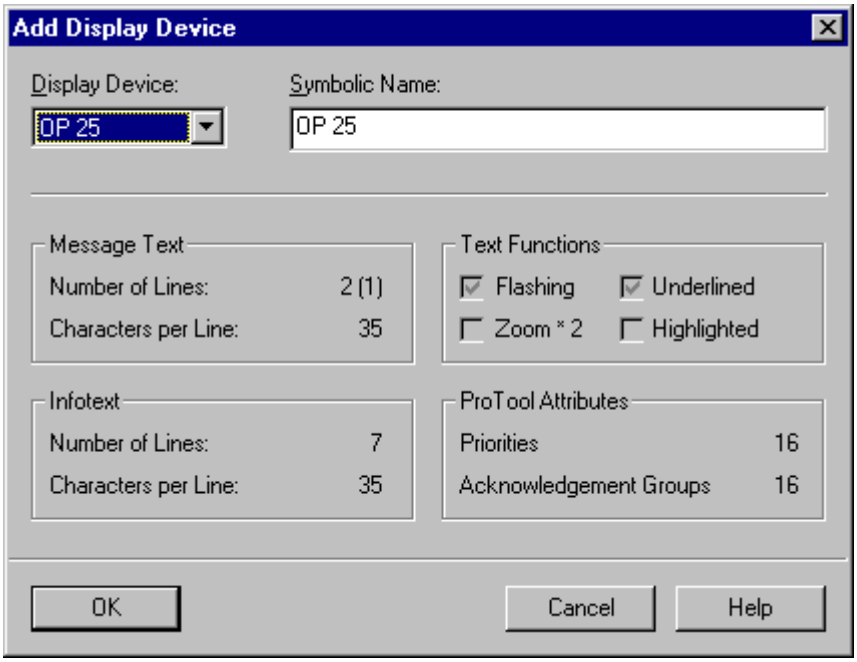
The *Special Object Properties – Message* dialog box then opens. As soon as you have selected a message from the list, you can specify general attributes for that message such as *Display Classes* and *Acknowledgement Method*. Those attributes are globally valid, i.e. they are not exclusive to a specific display unit.



General Attributes

In order to be able to specify attributes for a specific display unit, you must first create the display unit. To do so, click the *New Device* button.

The *Insert Display Unit* dialog box appears.



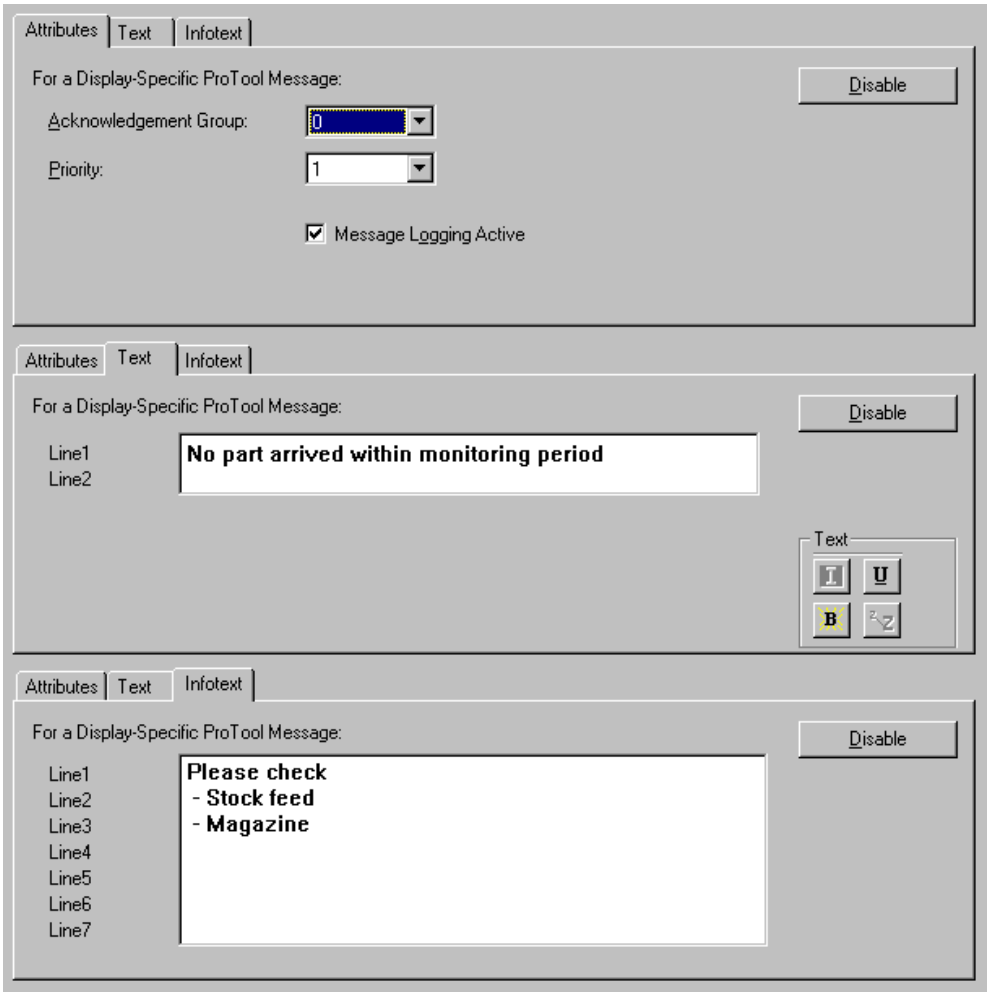
Inserting a Display Unit

There you select the required display unit and you can also assign it a symbolic name. Select device type *OP25* for the OP25, OP27, TP27–6 and C7-626 and device type *OP35* for the TP27–10, OP35, OP37 and TP37.

In the bottom section of the dialog box you will see the details of the display options for the selected device (you can not enter settings at this point).

Once you have selected a device, that operating unit appears in the *Special Object Properties – Messages* dialog box in the list of display units.

If you then select that operating unit, additional tabs appear in the lower half of the dialog box on which you can finally specify the device-specific settings.



Device-Specific Settings

For an OP25, for example, you can do the following:

- Specify acknowledgement group and priority
- Activate message logging
- Enter two lines of text of up to 35 characters in length and assign individual characters the attributes "flashing" and "underlined"
- Enter explanatory text which will provide the operator with additional information that can be obtained by pressing the Info key.

Finally, you confirm your entries by choosing *OK*.

Process Data in the Message Text

A message can include dynamically updated process data (associated data). For example, in the message, "Furnace 1: temperature 10.5 degrees too high", the figures "1" and "10.5" are process data.

Each ALARM_S message can supply one item of process data. That item of process data can, however, consist of an array of data so that in practice more than one item of data can be communicated. An array can contain a maximum of 12 bytes of usable data.

Whether and which process data is available depends on the PLC program. S7-GRAPH always automatically offers one item of process data. When programming in LAD/CSF/STL you must create the necessary program code yourself. S7-PDIAG does not provide any process data.

Syntax for Process Data

You can insert process data at any point within a message by using special syntax.

Every call of a process value starts and ends with a "@". Between these two characters are parameters specifying the value that will be output and the manner in which output will be formatted.

A maximum of four items of data can be included in each message.

Example:

The message

```
Furnace @1W%1d@: temperature @3W%4.1f@ degrees too high
```

might, for example, actually appear on the operating unit during operation of the system as

```
Furnace 1: temperature 10.5 degrees too high
```

The figures shown (in this case 1 and 10.5) represent the current process data.

Element Referenced

The parameters in front of the percent sign (%) specify the number of the element referenced and the data type of the array. In the example above, the elements 1 and 3 are referenced. The data type of the array is "W" (WORD).

The data type depends on the program code, as follows:

- In S7-GRAPH, an element of the type "W" (WORD) is always used.

- Otherwise, the following data types are permissible:

Data Type	Identification Code
BOOL	B
BYTE	Y
CHAR	C
WORD	W
INT	I
DWORD	X
DINT	D
REAL	R

Note
The element and data type do not need to be specified if the item referenced is the first element of an array of the type INT.

Formatting Output

The parameters between the percent sign (%) and the final delimiter (@) determine the output format of the data. The syntax is based (with some minor restrictions) on the familiar syntax of the C++ command `sprintf`. Flags for alignment of the output are not supported.

The first figure specifies how many characters are to be used for output. The number of characters includes the decimal point and decimal places if they are to be shown. In the example above, 1 character and 4 characters respectively are to be used for output of the data. If the actual figure to be displayed cannot be shown in full because it exceeds the number of characters specified, hash characters are printed in place of the digits, thus ###".

If the process data item to be displayed is a fixed point number, the number of characters may also be followed by a full-stop, followed by the number of decimal places to be shown. In the example above, one decimal place is specified for the second process data item. If the number of decimal places is not specified, no decimal places are shown.

Finally, the last parameter determines how the value to be displayed is interpreted and represented. In the example above, the first process data item is represented as a decimal number and the second as a fixed point number.

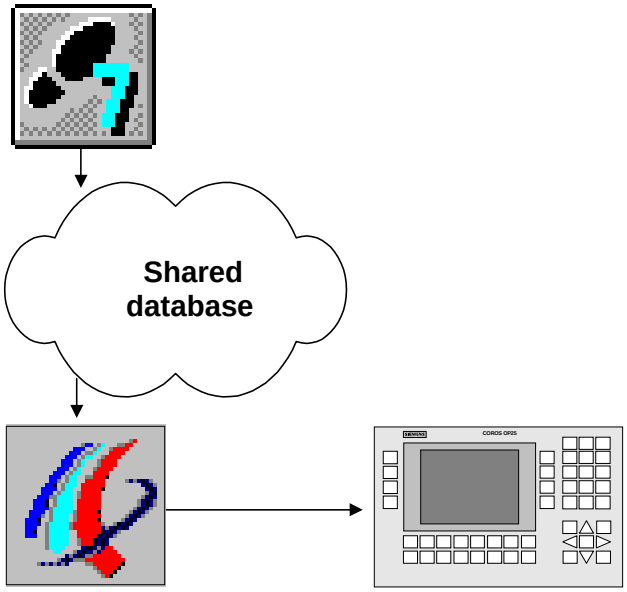
The following data types are permissible:

ID Code	Data Type	Max. Representable Range
d	Decimal with plus/minus sign	-2147483648..+2147483647
u	Decimal without plus/minus sign	0..4294967295
X	Hexadecimal	0..FFFFFFFF
f	Fixed point with plus/minus sign	-2147483648..+2147483647 Example: %8.2f produces the following Value of tag: 1234567 Output:12345.67
b	Binary	0.. 11111111111111111111111111111111

7.4 Incorporating ALARM_S Messages

Incorporating

When Configuring Messages in STEP 7 the message text and attributes entered are stored in the database shared with ProTool. During the process of compiling the project, ProTool automatically imports the necessary data and subsequently downloads it to the operating unit.



Configuring and Downloading ALARM_S Messages

It is therefore important that the shared database is always up to date during the compilation process and that data synchronization is active (see *Shared Database with STEP 7 (Chapter 6.1.2)*).

7.5 Use of Resources

ALARM_S messages are configured in STEP 7. The data is then stored in a shared database, imported during the process of compiling the ProTool project and finally downloaded to the operating unit.

That means that ALARM_S messages use up resources on the operating unit. The shorter the messages are, the less storage space they will require.

A maximum of 2000 event messages and 2000 alarm messages can be created. It is of no consequence in this regard which message procedure is used.

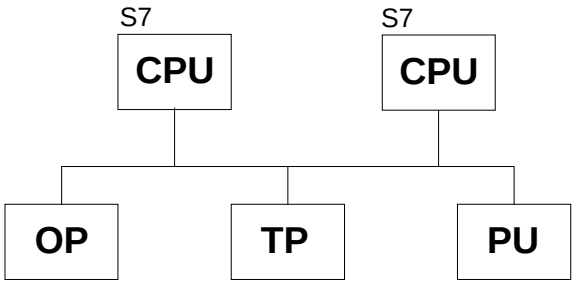
More detailed instructions can be found in the *Appendix (Chapter B.1)*. The appendix contains information about the memory requirement of configurations, in the basis of which you can assess whether or not the memory of your operating unit is large enough for the intended configuration.

Note
In STEP 7 there are restrictions regarding the number and size of tags that can be used within a message. For more precise details, please consult your STEP 7 documentation.

7.6 Communication Sequence

Logging On For ALARM_S

More than one station (e.g. more than one OP, PU, etc.) on a network can log on for ALARM_S messages. Each station that wants to display ALARM_S messages logs on to the CPU for ALARM_S.



When A Message Event Occurs

When a message-triggering event occurs, the CPU actively sends telegrams to that effect to all stations that have logged on. The message number identifies the corresponding message text that has previously been downloaded to the operating unit.

This means that the CPU does not have to be actively scanned for messages by regular polling as was the case with the message bit procedure. The operating unit, CPU and network are completely relieved of that burden on the system.

Time Stamp

With the ALARM_S procedure, the time stamp is not issued by the operating unit but by the CPU. The messages are stored in chronological order on the basis of their time stamp in the message buffer on the operating unit – even if they originate from different CPUs.

Information Stored

The CPU stores not only the time of the message but also the status (arrived, departed, acknowledged) and any process parameters. That information is retained until a message has been completely processed, i.e. until it has arrived, departed and been acknowledged. On the operating unit, the information in the message buffer is kept even longer.

7.7 Message Acknowledgement

ALARM_S Messages Requiring Acknowledgement

When a message is acknowledged by a station on the network, the CPU is immediately notified. The CPU then distributes the acknowledgement to all connected stations. It is only to this message that the operating unit responds, i.e. only at this point does it enter the acknowledgement in the message buffer.

Note
The CPU issues a time stamp for the acknowledgement event but does not store it. It is therefore not possible in the event of a subsequent update to determine whether or when a message has been acknowledged (see Updating (Chapter 7.10)).

ALARM_S Messages Not Requiring Acknowledgement

In the case of those ALARM_S messages that although they are configured as alarm messages do not require explicit acknowledgement by the user, the CPU acknowledges the message automatically when it arrives. The acknowledged event is then immediately entered in the message buffer along with the arrived event.

7.8 Printing Messages

You specify which messages are to be printed in the usual way in ProTool by choosing the menu option *System → Messages → Settings*.

Message Logging

If you do not specify any device-specific message settings in STEP 7 (see *Configuring ALARM_S Messages (Chapter 7.3)*), **all** message events are automatically logged directly to the connected printer.

If you configure device-specific messages, you can specify separately for each message whether it is to be logged or not.

If there are several CPUs in a network, this means that messages may not always be received in chronological order by the operating unit. Messages are always printed in the order in which they are sent by the CPUs. This is also the case with every synchronisation.

Printing Messages In the Event of a Buffer Overflow

Printing of the message buffer contents in the event of a Buffer Overflow is carried out in the same way as with the familiar message bit procedure. All messages are printed before being deleted.

7.9 Message Overload

It can happen that a large number of ALARM_S messages are issued within a short space of time. This can result in the build-up of processing backlogs.

Communication Overload

If the time gap between the first occurrence of a message and a subsequent occurrence is very short, it may be that the first message has not yet even been sent. In that case, the CPU reports the current status, i.e. the most recent occurrence of the message. Every station, i.e. including the operating unit, is informed at the same time, however, that at least one signal change that could not be sent has occurred.

The message number appears on the operating unit in inverted type (light letters on dark background) if multiple arrivals and departures of the message have not been able to be recorded.

```
*1234567 A KGQ HH:MM:SS DD.MM.YYYY GRU00
     Boiler 13: temperature 190 degrees
     Inform shift supervisor Tel. 007
```

Multiple Arrivals and Departures Could Not Be Recorded

CPU Memory Overload

If there are more messages pending than the CPU can process, any new messages are discarded. Only when a message has been fully processed can a new message be processed.

The date and time of a message appear on the operating unit in inverted type (light letters on dark background) if it is the last message that could be accepted by the CPU message buffer.

```
*1234567 A KGQ HH:MM:SS DD.MM.YYYY GRU00
     Boiler 13: temperature 190 degrees
     Inform shift supervisor Tel. 007
```

Last Message Accepted by the CPU

Operating Unit Memory Overload

An operating unit can process a maximum of approx. 200 simultaneously pending messages (total number of event and alarm messages). If the operating unit then receives more messages from the CPUs on the network, they can no longer be displayed. A system message to that effect is then displayed on the operating unit.

The maximum number of messages that could theoretically be simultaneously pending on an operating unit is calculated from the sum of the maximum numbers possible on the connected CPUs.

Example:

A CPU 315 can process a maximum of 50 simultaneously pending messages. Accordingly, an operating unit can handle a maximum of four CPU 315s sending ALARM_S messages without overflow problems occurring.

7.10 Updating

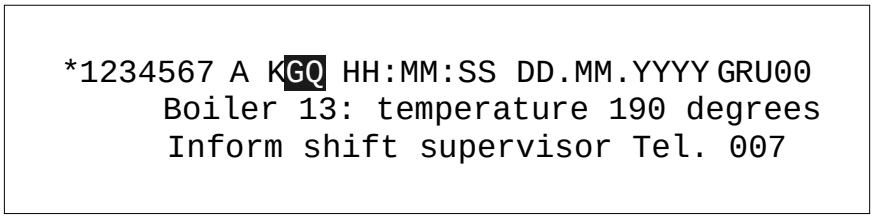
Since the CPU stores the message information when a fault occurs, individual network stations (e.g. an OP) can log on at a later date and obtain an update.

However, the CPU only stores information about pending messages. Once all events (arrival, departure, acknowledgement) have occurred, the message is deleted from the CPU.

When obtaining an update, therefore, the operating unit processes any missing events automatically if a message is not known to the PLC but the arrival and acknowledgement events are not entered on the operating unit.

The events are not entered in the message buffer in that case, however.

Events processed in this way are identified on the operating unit by displaying the message status symbols in inverse type thus:



Automatically Processed Events

7.11 Buffer Overflow

Message Archive

All message events for event and alarm messages are automatically stored in a message archive. The message archive can hold up to 512 message events.

Overflow Warning

When the remaining buffer capacity specified in ProTool (default setting 10%) is reached, an overflow warning is automatically issued.

Deleting Message Events In the Event of a Buffer Overflow

If the message archive has insufficient space to accept any more message events, message events are automatically deleted until the specified remaining buffer capacity is reached.

Deletion is carried out in the following order:

1. The oldest departed messages.

   For departed event messages, the message events 'arrival' and 'departure' are deleted. For departed alarm messages, the message events 'arrival', departure' and 'acknowledged' are deleted.

2. Pending messages.

   The oldest pending messages are deleted to make space for the newly received events.

Printout

If "Buffer Overflow Message Logging" has been specified and a printer is connected and switched on, all deleted alarm and event messages are printed out in the event of a buffer overflow.

Modifying the Diagnosis Screens 8

Overview

This chapter provides detailed background information on how you can modify the standard diagnosis screens where necessary and adapt them to specific requirements.

8.1 Modifying the Diagnosis Screens (Introduction)

Standard Screens

The standard diagnosis screens supplied with ProAgent enable you to perform all diagnosis tasks easily without having to bother with configuration yourself. You should take advantage of that opportunity and only make alterations to the diagnosis screens or create your own in exceptional circumstances.

Note
If you are using an upgrade of ProAgent, make sure that the standard screens match the current program release.
Instructions on how to adopt the latest diagnosis screens supplied with the upgrade into existing configurations can be found in the Installation Instructions manual of the upgrade.

You can ignore this and the following chapters if you are not intending to make any alterations to the diagnosis screens.

Caution
If you make changes to the diagnosis screens, please be sure to take note of the guidance offered, as otherwise the functional capability of the diagnosis system could be significantly impaired.

Sensible Adaptations

The diagnosis screens have a uniform design that is based on the design of the standard screens supplied with ProTool. That design represents the best possible compromise between a range of different requirements profiles but can, of course, not reflect very specific requirements in particular cases.

If your system is particularly complex you might decide, for example, to use a smaller font size so that more units can be shown on the display at once.

Or you may have no use for certain items of information and therefore delete the output fields concerned.

And, of course, you can always adapt the layout to match the rest of your project, use different pictograms or colors, change the soft key assignments and restrict the use of certain functions by password protection.

Designing Your Own Screens

You will only need to create your own diagnosis screens or merge diagnosis screens with other screens on your system in very rare cases.

In principle, this is possible but a diagnosis screen must always be used as the "master". As the next step, you can then delete all elements that you do not require.

Following this procedure ensures that all functions required for diagnosis are present (e.g. `ProAgent: Switch Cursor`, `ProAgent: Identify Screen Type` and `ProAgent: Specify Geometry`).

Fundamental Rules

The **fundamental rules** can be summarized as follows:

- Always modify existing diagnosis screens - do not create completely new diagnosis screens.
- Do not copy elements from a diagnosis screen to a system screen, instead, where necessary, copy elements from a system screen to a diagnosis screen.
- It is not possible to combine several diagnosis screens or elements from them into a single screen. For example, you can not combine the functions of the Overview Screen and the Movement Screen or the Overview Screen and the Detail Screen to form a single screen. Each screen is assigned a specific screen type by means of the function `ProAgent: Identify Screen Type` and is thereby allocated a quite specific task within the diagnosis system.
- Observe the limitations on cursor control resulting from the diagnosis functions.

Use the *Display hidden buttons* key to display the Selection and buttons in the diagnosis screens for the TP.

8.2 Internal Structure of the Diagnosis Screens

Conventions

The powerful process diagnosis system involves a particularly complex process and therefore demands that certain rules and conventions are adhered to. The diagnosis screens supplied with ProAgent conform to those rules.

If you make modifications to the screens you must make sure that the changes you make do not break any of the rules.

This applies particularly to minor and apparently insignificant alterations. You can not, for example, simply delete certain screen elements without further thought.

Tag Indices

Tags that are used for input/output fields in the diagnosis screens require an internal four-digit index. The index values are set with the aid of the function `ProAgent: Set Tag Index`

Internal linking of the tags to the indices is necessary in order that the operating unit can supply those tags with the current diagnosis data.

The indices are allocated on the basis of a fixed number code. They are therefore **not** randomly assignable.

You can identify the number code by looking at the parameters of the function `ProAgent: Set Tag Index` for a number of the tags used on the diagnosis screens.

If you wish to add a tag to a project for a specific purpose (e.g. to extend the display by a line), increase the index by one increment.

Example:

On the Overview Screen (ZP_UNITS) on the OP25, 7 units are displayed on 7 lines. The tags used for the input/output fields include ZP_UUNIT_NA0, ZP_UUNIT_NA1, ..., to ZP_UUNIT_NA6.

The tags are assigned the following tag indices in ascending order:

Tag	**Index**
ZP_UUNIT_NA0	1,0,3,0
ZP_UUNIT_NA1	1,0,3,1
...	...
ZP_UUNIT_NA6	1,0,3,6

The number of lines is 7.

If you now want to add an extra line to the display and require a new tag for the input/output field, it makes sense to give it the name ZP_UUNIT_NA7. For that tag you **must** then configure the function `ProAgent: Set Tag Index` using the index values 1,0,3,7.

Consequences:

Since the indices increase incrementally in ascending order, you must not alter the order of individual fields and lines within a screen. When deleting individual elements, you should always start deleting from the end/bottom.

Line Number and Column Number

The number of lines and columns on the individual diagnosis screens has to be stored as the start value of certain tags. The value of those tag tells the operating unit how many input/output fields there are to be supplied with data.

The following tags are of significance to the various diagnosis screens:

Diagnosis Screen	Tag	Meaning of Start Value
ZP_ProAgent (Diagnostics Start Screen)	–	–
ZP_ALARM (Message screen)	–	–
ZP_UNITS ZP_UNITS_S7G (Overview screen)	ZP_UACT_MAX ZP_UROWS	Max. number of action numbers/ transition numbers displayed Max. number of units displayed (scrollable lines)
ZP_MOTION (Movement screen)	ZP_MCOLUMNS ZP_MROWS	Max. number of target positions Max. number of movements displayed
ZP_STEP (Step screen)	ZP_SACT_MAX	Max. number of action numbers/transition numbers displayed
ZP_DETAILSYM (Signal list detail screen) ZP_DETAILAWL (STL detail screen)	ZP_DROWS ZP_DTRAN_MAX	Max. number of instructions displayed Max. number of action numbers/ transition numbers displayed
ZP_DETAILLAD (LAD detail screen)	ZP_DLAD_COL ZP_DLAD_ROWS ZP_DTRAN_MAX	Max. number of adjacent switches Max. number of vertically adjacent switches Max. number of action numbers/ transition numbers displayed

Tags with Important Start Values

Consequences:

If the number of fields or lines changes, the start value of the corresponding tags must be modified to match the new number of lines or columns.

Dynamic Attributes

Many input/output fields use dynamic attributes to control display of inverse type or flashing characters.

If you add new lines, you must similarly define the appropriate dynamic attributes and assign them the correct values (see *Adding or Removing Lines (Chapter 8.4.3)*).

Showing/Hiding Lines

Lines that are not required are hidden when the system is running. To achieve this, many fields are configured with a show/hide attribute.

If you add new lines, you must similarly configure a show/hide attribute (see *Adding or Removing Lines (Chapter 8.4.3)*).

Selecting and Scrolling (TP only)

With a touch panel (TP), selecting and scrolling are performed by directly touching specific areas of the screen. This means, then, that each screen contains hidden buttons in addition to the visible keys.

If you alter the way a diagnosis screen is laid out, e.g. by adding lines or columns, you must also adjust the size and position of these buttons accordingly (see *Adding or Removing Lines (Chapter 8.4.3)*).

Functions Linked to Screen Selection

Specific functions that control important processes are linked to selection of the diagnosis screens. Examples of the functions involved are `ProAgent: Switch Cursor`, `ProAgent: Identify Screen Type` and `ProAgent: Specify Geometry`. You must not delete those functions.

8.3 Internal Nomenclature

Common Prefix "ZP_"

So that all the elements which affect process diagnostics are listed together in the different editors of ProTool, all names begin with the abbreviation "ZP_". (The "Z" ensures that these elements are placed at the end of the lists - in other words, they appear after your own elements. The "P" stands for "ProAgent".)

Since ProAgent is used in a large number of countries all over the world, all names are in English.

Diagnosis Screen Names

The names of the standard diagnosis screens supplied are as follows:

Name	Diagnosis Screen
ZP_PROAGENT	Diagnosis Start Screen
ZP_ALARM	Message Screen
ZP_UNITS	Overview Screen
ZP_UNITS_S7G	Alternative Overview Screen for S7-GRAPH
ZP_DETAILSYM	Detail Screen (signal list format)
ZP_DETAILAWL	Detail Screen (STL display mode)
ZP_DETAILLAD	Detail Screen (LAD display mode)
ZP_MOTION	Movement Screen
ZP_STEP	Step Screen

Names of the Diagnosis Screens

Tags for Each Diagnosis Screen

In order to simplify assignment of tags, the tag names always start with the first letters of the name of the screen on which they are used.

Example;

- All tag names for the Overview Screen start with ZP_U...
- All tag names for the Detail Screens start with ZP_D...

etc.

8.4 Modifying Design and Information Content

8.4.1 Modifying the Design

You can modify the design of the diagnosis screens at any time in the same way as you are familiar with in ProTool. For example, you can use different pictograms, colors or fonts.

Caution
If you delete individual elements or lines from a diagnosis screen or add new ones, make sure you follow the guidance notes given in the chapter *Adding or Removing Lines (Chapter 8.4.3)*. Otherwise the functional capacity of the diagnosis system could be significantly impaired.

Tip
You can modify several elements at once by holding down the Shift key and selecting all the elements you wish to change. When you have selected all the desired elements, you can then assign the new properties collectively.

8.4.2 Change Font Size and Font

On any operating unit, there is only a limited area available for display of information. For that reason, only a limited amount of information can be shown at a time. That amount of information can be increased by reducing the size of the font, though at the price of a corresponding loss of legibility. What's more, operating with a touch panel can be made more difficult if screen elements are too small.

Which criterion is given the greater priority, i.e. maximizing the amount of information displayed or optimizing the legibility of that information and ease of operation, depends on the nature of the individual application and can not be decided on the basis of a universal formula. The diagnosis screens supplied with ProAgent represent the best compromise for the majority of applications.

If you wish to see more information on a diagnosis screen, you can change the font size by selecting a smaller font size.

To change the font size or font of text, perform the following steps:

1. Make sure that the font and font size you want have been defined for the configured languages by choosing *System → Fonts* from the menu. If necessary, select a different font.
2. Open the screen on which you wish to make the alterations.
3. If you wish to increase the size of the font, first delete enough lines so that no text will subsequently be covered over. When doing so, be certain to follow the guidance notes given in the chapter *Adding or Removing Lines (Chapter 8.4.3)*.

4. Select the text to which you wish to assign the new font.
5. Choose the *Edit → Fonts* from the menu and select the font you require.

   All previously selected text is now shown in the new font. If you subsequently create new text fields, the new font will also be used for them.

   Note for TPs
   Use at least font size 8x16 or better still a font with the height 32. If you don't, the text elements will be too small for you to be able to select them.
6. If you have reduced the font size, you can join lines together and add extra lines to the diagnosis screens. When doing so, be certain to follow the guidance notes given in the chapter *Adding or Removing Lines (Chapter 8.4.3)*.

Tip
You can modify several text elements at once by holding down the Shift key and selecting all the elements you wish to change. When you have selected all the text elements you wish to change, you then select the new font and assign it collectively.

8.4.3 Adding or Removing Lines

Basic Requirements

Before you add extra lines to a diagnosis screen, you normally first have to reduce the font size (see *Changing the Font Size and Font (Chapter 8.4.2)*).

Or you must delete individual screen elements that you do not require.

Options

Depending on the diagnosis screen involved, you can do the following:

- Display more units simultaneously on the overview screen (ZP_UNITS or ZP_UNITS_S7G)
- Show more instructions simultaneously in the detail screen in signal list and STL format (ZP_DETAILSYM und ZP_DETAILAWL)
- Display more switches at once on the Detail Screen in LAD display mode (ZP_DETAILLAD)
- Delete the last movement on the Movement Screen (ZP_MOTION) if you want to use the soft keys for different functions

Copy Existing Lines

The simplest method is to copy an existing line to the Clipboard and paste a new copy at the new position. You should always copy the bottom line. The necessary modifications are then simpler to perform because most values merely need to be increased by one increment.

Start Values

You must inform ProAgent how many lines and columns there are on the screen concerned. This is done by means of the start value of specific tags. If you have added or removed lines, therefore, you must also change the start values of those tags. A list of the tags involved is given in the chapter *Internal Structure of the Diagnosis Screens (Chapter 8.2)*.

Setting Tag Indices

All input/output fields that you add must be linked to the correct tags, and those in turn to the correct tag indices in order that they can be supplied with the correct data when the system is running. To do so, you configure the function `ProAgent: Set Tag Index` for the tags concerned. For precise details, refer to the chapter *Internal Structure of the Diagnosis Screens (Chapter 8.2)*.

Dynamic Attributes

Many input/output fields use dynamic attributes to control display of inverse type or flashing characters. Those attributes are set via a control tag that must be linked to the correct tag indices in order that they can be supplied with the correct data when the system is running.

You must set the values for the dynamic attributes accordingly for every field on every line and make sure that the correct control tag is assigned. The simplest way is to look at the values of the dynamic attributes of existing fields from which you will quickly recognize the basic formula.

Showing/Hiding Lines

If, when the system is running, not all lines are required for display of data, those lines should appear blank. On the Overview Screen (ZP_UNITS), for example, this will be the case if there are only a few units in your system

The lines concerned then remain blank.

The showing/hiding of lines is controlled by the value of a tag. On the Overview Screen, for example, this is the tag ZP_UROWS_ON. When the system is running, the value of that tag corresponds to the number of lines to be displayed.

You must set the value for hiding accordingly for every field on every line. The simplest way is to look at the settings for hiding the existing lines from which you will quickly recognize the basic formula.

Adjusting Selecting and Scrolling (TP only)

If you change the display of the Detail Screen (STL), you only have to adjust the scroll areas, since not every line can be selected individually in these areas. Use the mouse to enlarge the corresponding buttons, so that the new line(s) are also covered.

If you change a diagnosis screen in which the lines or columns can be selected individually (that is an Overview Screen, Message Screen, Movement Screen or Detail Screen (LAD)), you must cover each new line with a new (hidden) button.

You can also make this job easier for yourself by simply copying the bottom button and positioning it over the new line. All you then have to do is adapt the parameters of the `ProAgent: Select Screen Element` and `ProAgent: Scroll Display` functions configured for the button. The simplest way is to look at the parameters of the existing buttons from which you will quickly recognize the basic formula.

Tip

Use the Display hidden buttons *key to display the Selection and Scroll buttons in the diagnosis screens for TP.*

8.4.4 Displaying Symbols and Remarks (Detail Screen, STL Display Mode)

Limited Space on C7-626, OP25, OP27, TP27–6

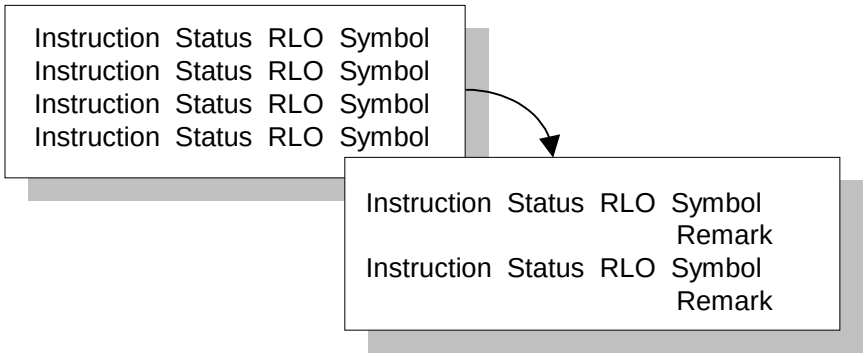
On the C7-626, OP25, OP27 and TP27–6, either a symbol, comment or the absolute address of a statement is displayed on the Detail Screen (STL or signal list). You can switch between the various display modes by way of an input field with a list of options.

You can modify the Detail Screen (STL or signal list) to display the symbol and comment at the same time.

Note
On the OP35/OP37, TP27–10 and TP37 symbols and remarks are already displayed alongside one another. The following description therefore refers solely to projects for the C7-626, OP25, OP27 or TP27–6.

In order to create sufficient space on the display, delete every second line. Place the additional output fields on the lines thus freed. The symbol and remarks will then appear one underneath the other.

Since two lines are now required for each instruction, only half the number of instructions can be display at once as with the standard layout.



Displaying Symbol and Remarks at the Same Time (OP25)

Proceed As Follows

To have symbol and remarks displayed simultaneously:

1. Delete the bottom four lines on the list of instructions (it is important that you delete the bottom lines and not any others).
2. With the exception of the top line, space out the remaining lines evenly over the free space thus made available. This should mean that there is at least one blank line between the lines.
3. On each line, make a copy of the output field for *symbol/remarks* and insert the copy in the blank line below the original field (it is important that you recopy the field for each line and do not insert multiple copies of the same field).
4. For each of the output fields (both original and copy) delete the multiplex functions (to do so click the *Multiplex* button and the two *Remove* buttons).
5. Assign the output fields on the longer lines (i.e. on the lines on which the actual instructions appear) the following tags:
   - first line: ZP_DSYMBOL0
   - second line: ZP_DSYMBOL1
   - ...
6. Assign the output fields on the in-between lines the following tags:
   - first line: ZP_DCOMMENT0
   - second line: ZP_DCOMMENT1
   - ...
7. If you have changed the length (width) of the output fields, you must also change the length of the tags ZP_DSYMBOL0 ... ZP_DSYMBOLX and ZP_DCOMMENT0 ... ZP_DCOMMENTX to match the new field lengths.

8. For TP only: Check whether the Scroll buttons still match the new layout of the display. If necessary, adjust the size of the touch areas.

When the system is running, the symbols will now appear on the operating unit on the full-width lines and the remarks on the in-between lines.

8.4.5 Switching Over SIMATIC/IEC Display Mode (Detail Screen)

The SIMATIC display mode is used for commands, operands and operators in the Signal List (ZP_DETAILSYM), STL (ZP_DETAILAWL) and LAD (ZP_DETAILLAD) detail screens.

If you prefer the (international) IEC display mode, you can change this setting by configuring the `ProAgent: Switch Over SIMATIC/IEC` function with an appropriate parameter for the Detail Screen in question.

If this function is not configured for a Detail Screen, the SIMATIC display mode will automatically be used for German, while the IEC display mode will be used for all other languages.

Proceed As Follows

To switch the display mode over from SIMATIC to IEC:

1. Click the right mouse button in the Detail Screen in question and select *Properties* → *Functions*.
2. In the function group *ProAgent*, select the function `ProAgent: Switch Over SIMATIC/IEC`.
3. Under *Parameters* set *Mode* = 1 (IEC display mode).
4. Under *Conditions* select the condition *Select Screen*.

All commands and operands will now be displayed in IEC display mode in the Detail Screen in question.

8.4.6 Changing the Mode of Enabling Movements (Movement Screen)

Default Setting in the Diagnosis Screens

All the movements displayed in the Diagnosis Screens for OPs can be triggered by means of soft keys.

In the case of a TP, safety reasons dictate that you can normally only trigger a movement manually if it has been selected beforehand. Movements that have not been selected are disabled

Changing the Default Setting

You can switch over this default setting however in the Movement Screen.

This is configured in the screen editor by choosing the menu option *Edit* → *Properties* → *Functions*. Set the *Mode* parameter appropriately for the `ProAgent: Define Enabling of Movements` function:

- For a TP *Mode* = 1: automatic enabling of all movements
- For an OP *Mode* = 0: only the selected movement is enabled

Under the *Duration* parameter set the number of seconds after which the screen element is to be automatically deselected and under *Conditions* select *Select Screen*.

Note
When working with an OP, make sure you use the Movement Screen of the latest version of ProAgent, since changing of the default settings is only provided for in this version. Instructions on how to adopt the latest diagnosis screens supplied with the upgrade into existing projects can be found under *Upgrading Existing Projects to New Diagnosis Screens (Chapter 6.2.3)*.

Further Steps To Be Taken With A TP

When you are configuring for a TP, you also have to adjust the Selection and Scroll buttons. All that is now required are two Scroll buttons in the centre of the display (similar to the Detail Screen (STL)). The buttons on the left and right above the arrows, which trigger the movements, must of course be left unchanged.

Proceed as follows:

1. Delete the bottom buttons in the centre of the display until only the top two buttons remain.
2. Use the mouse to enlarge the lower button so that it covers the second line and all other lines below it.
3. Select the `ProAgent: Scroll Display` function for both buttons and and then click *Events...* for both buttons.
4. Activate the *Press key* check box.
5. Delete the `ProAgent: Select Screen Element` function for both buttons.

You can now scroll the Movement Screen in the same way as you are used to doing with the Detail Screen (STL).

8.4.7 Changing the Number of Target Positions (Movement Screen)

The Movement Screen (ZP_MOTION) normally shows 8 target positions for each movement.

Depending on your system, however, there may be more, or perhaps fewer, target positions than that. ProAgent supports up to 16 target positions for each movement.

Adding Target Positions

To add extra target positions on the Movement Screen, you must work line by line. This is important because the individual fields are configured with functions organized on a line-by-line basis.

1. Shift the existing target position symbols to the left until there is enough space on the right for an extra symbol.
2. On the line you are modifying, copy the far right target position symbol to the Clipboard.
3. Paste the copy in the empty space.
4. Double click the symbol to edit the input/output field.
5. Under *Tag*, open the menu and select *Duplicate*.
6. Then select *Edit* from the same menu.
7. In the dialog box for entering the tag parameters, select the *Functions* tab, then under *Selected Functions* click the item *ProAgent: Set Tag Index* and then click the *Parameters* button.
8. In the *Parameters* dialog box, position the cursor on *Index 4* and increase the *value* specified by 1.
9. Finally, close all open dialog boxes by choosing *OK*.
10. Repeat steps 1 to 9 until you have the desired number of target positions on the line you are modifying.
11. Set the value for hiding for every symbol on the line. You count from the extremities inwards, starting from the far left, moving to the far right and so on. With 10 target positions, for example, the figures would be as follows from left to right:
    1 – 3 – 5 – 7 – 9 – 10 – 8 – 6 – 4 – 2
12. Repeat the complete process for all other lines until there are the same number of target positions on each line.
13. Finally, you must set the start value of the tag ZP_MCOLUMNS to the number of target positions defined for each movement. That start value tells the operating unit how many target positions there are to be supplied with data.

Deleting Target Positions

You do not normally need to delete excess target positions as they are automatically hidden if they are not needed.

If you nevertheless want to delete surplus target positions, proceed as follows:

1. Delete the surplus target positions from each line, starting from the right.

   All lines must have the same number of target positions.

2. Shift the symbols as you require. Do not, however, alter the order of the symbols relative to one another and do not shift symbols onto a different line.

3. Set the value for hiding for all symbols. You count from the extremities inwards, starting from the far left, moving to the far right and so on. With 10 target positions, for example, the figures would be as follows from left to right:
   1 – 3 – 5 – 7 – 9 – 10 – 8 – 6 – 4 – 2

4. Alter the start value of the tag ZP_MCOLUMNS to the number of target positions now remaining for each movement.

8.4.8 Defining Filter Criteria (Message Screen)

The Message Screen (ZP_ALARM) makes use of a truncated ProTool Message Page for the purposes of displaying messages (see *Message Window and Message Screen (Chapter 6.2.4)*).

You can filter the messages using the same filter function and filter criteria as you are familiar with in ProTool. This is done with the `Filter Messages` function. In addition to the known range of functions, there is the "Diagnostic Messages" parameter.

That parameter can have the value 0 or 1 as follows:

- 0 = Display all messages
- 1 = Display diagnosis messages only

This key also invokes the filter function. You can change the filter criteria of the function or assign other keys additional filter functions.

A detailed description of the function `Message Filters` is provided in the ProTool reference documentation.

A detailed description of the function `Message Filters` is provided in the ProTool Online Help.

8.4.9 Defining Operating Modes (Overview Screen)

On the Overview Screen (ZP_UNITS or ZP_UNITS_S7G) the user can change the operating mode of a unit by means of an input field. That input field is password protected. The password level is set to 8 as the default.

Operating modes are referenced by a 16-bit value and must be uniform across the whole S7 project. Each bit identifies an operating mode. The operating modes for Automatic (Bit 0) and Manual (Bit 1) are permanently fixed.

Each unit has an operating mode that is independent of the operating mode of the superior or subordinate units.

Note
If changing the operating mode of a parent unit is to affect all subunits, this must be implemented in the PLC program.

The preset names are "Auto", "Man." and "Mod02" to "Mod07".

To change those names, edit the text or graphic list ZP_MODE. If you are creating multi-language projects, you must also take account of the relevant foreign languages.

8.5 Using Additional Functions

8.5.1 Working with Password Levels

Input fields and keys can be password protected. Use of those keys/fields is then restricted to suitably authorized and qualified personnel. Password protection can, of course, also be incorporated in the diagnosis screens.

The default setting for all keys is no password protection (password level 0).

By altering the password level you could, for example, prevent an operator

- selecting specific screens
- setting the operating mode on the Overview Screen
- executing movements on the Movement Screen

You set the password level in exactly the same way as you are familiar with in ProTool.

8.5.2 Multi-Language Projects

All text that appears on the diagnosis screens is basically stored in multi-lingual form provided that facility is supported by STEP 7. When the function `Language` is executed, the screen is reconstructed in the relevant language.

Most text items are not configured in ProTool but provided by the S7 packages. Conflicts can occur if no text items have been defined in STEP 7 for the language configured in ProTool. A warning message to that effect is then issued during the compilation process in ProTool. When the system is running, the text is shown in the default language.

For more details of configuring in different languages, please consult your User's Manual entitled *Configuring ProTool Graphics Displays*.

8.5.3 Configuring a Unit Acknowledgement

Unit acknowledgement should not be confused with message acknowledgement!

For each unit there is one bit on the PLC which can be used for acknowledging the unit. That bit can be set with the aid of the function `ProAgent: Acknowledge Unit`.

The most efficient way of configuring the function `ProAgent: Acknowledge Unit` is to assign it to a global function key. When the system is running, pressing that key will acknowledge the following unit, depending on the diagnosis screen displayed:

- the unit to which the message selected on the Message Screen belongs
- the unit selected on the Overview Screen
- the steps of which are displayed on the Step Screen
- the unit whose movements are displayed on the Movement Screen
- the unit whose signals are displayed on the Detail Screen

In order to be able to acknowledge a unit, the UDT "Unit" must be used in S7-PDIAG. The function `ProAgent: Acknowledge Unit` only sets the relevant bit. The PLC must make sure that the bit is reset again after acknowledgement.

8.5.4 Moving Directly to the Detail Screen

If you attempt to call up the Detail Screen (ZP_DETAILSYM, ZP_DETAILAWL or ZP_DETAILLAD) from any screen other than the Message Screen (ZP_ALARM), a system message is normally returned.

The reason for this is that you will not have been able to select an alarm message and the system will therefore not have been able to identify for which message the process diagnosis is to be performed.

In principle, however, it is possible on an OP to open the Detail Screen from any other screen as long as the Message Screen is visible. In that case, the system will know for which message the process diagnosis is to be carried out.

In order to be able to open the Detail Screen from any point, you must on an OP assign a corresponding screen selection function to a global function key.

If, when the system is running, the Message Window then appears, you can use the Change Window key to switch to that window and then use the specially configured function key to call up the Detail Screen.

On a TP, you must assign a corresponding screen selection function to a button in the screen from where you want to open the Detail Screen. A global opening function is not possible on a TP.

8.6 Using Direct Keys

8.6.1 Direct Keys (Introduction)

In Movement Screens (ZP_MOTION) of the standard projects, movements are triggered by means of the `Set Bit` function. As an alternative, you can also use the direct key functionality to operate your installation.

Direct keys enable you to implement operating actions quickly without any communication-related delays. Quick operating actions are essential, for example, for typing mode.

You can use two different types of direct key depending on the hardware:

- PROFIBUS Direct Keys
- Direct keys for activating the direct key module

It is not possible to use PROFIBUS direct keys and direct keys for the direct key module at the same time within a project.

If you use the F and K keys on an OP as direct keys, all you require is the appropriate hardware and hardware configuration.

Configuration on a TP is conducted by means of the `Direct Key` function.

PROFIBUS Direct Keys

You use PROFIBUS direct keys to set bits in the I/O area of the SIMATIC S7 directly from the operating unit. The bit area is defined in STEP 7. The bit is set when you touch the direct key and reset again when you release the key or exit the screen.

Basic Requirements

- You have installed, that is, integrated ProTool at the time of generating the configuration.
- During operation, the operating unit is connected to a SIMATIC S7 by means of PROFIBUS-DP.
- You have defined the bit area for direct keys in STEP 7. (Information relating to configuration can be found in the User's Manual entitled *Communication*.)

If these basic requirements are not met, ProTool interprets the configured button as a direct key to be used for activating the direct key module. The number of PROFIBUS bits that can be manipulated by means of direct keys depends on the device:

Device	Number of bits
OP25, OP27, TP27–6	24 (0...23)
OP35, OP37, TP37, TP 27–10	40 (0...39)

Direct Keys for Direct Key Module

You can use these direct keys to activate the outputs (ports) of the optional direct key module at the rear of the operating unit. The port is set when you touch the key and reset again when you release the key. Further information about the direct key module for OPs can be found in the User's Manual entitled *Communication*and about that for TPs in the Equipment Manual entitled *Touch Panel TP27, TP37*.

Basic Requirements

The operating unit is equipped with a direct key module and the PROFIBUS direct keys are not configured. The number of ports that can be configured depends on the device:

Device	Number of ports
OP25, OP27, TP27–6	8 (1...8)
OP35, OP37, TP37, TP 27–10	16 (1...16)

Each direct key module for OPs is equipped with 8 ports. If you want to be able to configure 16 ports on an OP35 or OP37, the OP must be equipped with two direct key modules.

8.6.2 Configuring Direct Keys (TP Movement Screen)

You can use direct keys in the Movement Screen (ZP_MOTION) to trigger movements without communication-related delays. To this end, you have to assign the function `Direct Key` together with the function `Set Bit` to those buttons that are to be used to trigger the movements . You can also use this function to set assignment of the pressed key and set bit.

To use a button on the TP as a direct key:

1. In the open screen, select the button to which you want to configure a direct key.

   If the hidden buttons are not displayed:
   Use the *Display hidden buttons* key to display the Select and Scroll buttons in the diagnosis screen for the TP.

   The *Button* window opens.

2. Assign the function `Direct Key` from the *Keyboard* group to the button.
3. Specify the port number or the number of the bit that is to be set when the button is touched as the parameter .

4. If necessary, assign a password level to the button on the *Enable* tab, so that only authorized persons are able to use it.

   ProTool interprets the number entered in step 4 as a PROFIBUS bit number if all of the following conditions are met at the same time:

   - You have installed, that is, integrated ProTool at the time of generating the configuration.
   - During operation, the TP is connected to a SIMATIC S7 by means of PROFIBUS-DP.
   - You have defined the bit area for direct keys in STEP 7 and the corresponding bits are set in the PLC. (Examples of how to program direct keys for various purposes can be found in the User's Manual entitled *S7-PDIAG*.)

   If not, the number entered is interpreted as a port number for the direct key module. If the number is greater than the number of ports available, an error message is output during generation.

Caution
In order to ensure safe operation of the installation when using direct keys, you should query the screen number in the PLC as the condition for triggering direct key.
To this end, use the `PROFIBUS Screen Number` function to transmit the screen number to the PLC at the same time as the direct key. Further information about this function can be found in the *Online Help for ProTool*.

8.6.3 Using Direct Keys (OP Movement Screen)

You can use the F and K keys in the OP movement screens (ZP_MOTION) as direct keys and in this way trigger movements without communication-related delays.

All that has to be done to enable direct keys to be used on an OP is to carry out the appropriate configuration. The assignment of the key and of the bit set when the key is pressed is fixed. The exact assignment can be found in the User's Manual entitled *Communication*.

Configuration involves the following steps:

- The OP must be configured as the active user (master) for general communication (reading and writing of tags).
- To enable DP direct keys to be used, the OP must also be configured as a slave in the PROFIBUS–DP network.

Detailed information about this can be found in the User's Manual entitled *Communication*.

Configuring The OP As Master

To configure the OP as the active user for general communication, please proceed as follows:

1. Generate a STEP 7 project and configure the hardware with a DP-compatible CPU.
2. Copy a standard project (e.g. for OP25) to your STEP 7 project. The standard projects are located in the STEP 7 project named *ProTool*. Open ProTool by double-clicking the operating unit.
3. Select the menu item *System* → *PLC* and click the *Edit* and *Parameters* buttons one after the other.
4. In the dialog box now open, select the network and the CPU to which the operating unit is to be connected. The network parameters are then taken over.

You have now configured the operating unit as the active user (master) in the PROFIBUS–DP network.

Configuring The OP As A PROFIBUS–DP Slave

If you want to be able to use DP direct keys, you have to configure the OP as a PROFIBUS–DP slave. The operating unit is configured with the same address both as the active user and as a DP slave.

1. Start the STEP 7 hardware configurator and in the hardware catalogue under *stations already configured* in the *SIMATIC OP* group, select the corresponding hardware, e.g. *OP25 DP KEYS*.
2. Connect the OP to the DP network. You are then presented with a list of all the operating units already configured in this network.
3. Select the operating unit with the same address as the OP has as master.
4. You are now also able to configure CPI modules in addition to the DP direct keys.

Your hardware is now configured for the use of DP direct keys.

8.6.4 Important Information About Using Direct Keys

A number of points must be observed when using the direct keys in a project:

- After a system crash, the operating unit does indeed reset all enable functions during startup, but the direct keys are available as soon as voltage is applied. In order to prevent incorrect movements during the time the operating unit takes to start up again, you must monitor the failure of the operating unit and if necessary cancel the enable functions and/or display orders output by the PLC program. (Further information can be found in the User's Manual entitled *S7-PDIAG*.)

  It makes sense to use the slave monitoring OBs when using DP direct keys.

- To guarantee proper functioning of the direct keys on a TP:
  - Do not position any direct keys in the fixed window
  - Do not configure any trend graphics in a screen containing direct keys
  - Do not configure any trend graphics in the fixed window
  - Erroneously triggered movements can arise if you have used the same port twice. For this reason, make sure that you use each port only once.
  - The `Direct Key` function can be used only once per button.

Appendix System Messages

A

Overview

This Appendix contains a reference list of all system messages that are displayed on the operating unit in the event of an error. It provides information about possible causes of errors and how they can be remedied.

System messages inform you about critical operating conditions on the operating unit. As soon as such an operating condition occurs, the operating unit automatically displays a window showing a system message.

A description of the standard system messages is given in the device manual for your operating unit.

There are, however, a number of other system messages that are related to the process diagnosis functions. Only those system messages are described here.

You can look up the explanation easily by the message number.

A.1 General System Messages

A.1.1 Error Initializing Process Diagnosis

Message Number	Cause/Remedy
4000	Initialization of communication between PLC and operating unit failed when the diagnosis firmware was launched. Make sure that you have the correct version of the firmware on your operating unit. Switch off operating unit and PLC. Check all connections and then restart.

A.1.2 Not Enough Memory for Process Diagnosis

Message Number	Cause/Remedy
4001	A memory request by the diagnosis package failed. There is not enough memory available on the operating unit for process diagnosis. Check that the operating unit hardware meets the system requirements. When powering up the operating unit, check whether hardware faults are reported during the memory test. If necessary, simplify your project by dispensing with unnecessary OEM functions.

A.1.3 Diagnosis Data Inconsistency Between PLC and Operating Unit

Message Number	Cause/Remedy
4002	A conflict has occurred between the action numbers stored on the PLC and the numbers expected by the operating unit. In order to obtain data consistency, first retranslate the STEP 7 program and then reload it onto the PLC. Then recompile the OP project in ProTool and download it to the OP.

A.1.4 Unit has been Acknowledged

Message Number	Cause/Remedy
4081	This system message confirms successful acknowledgement of the current unit.

A.1.5 Unit Could Not be Acknowledged

Message Number	Cause/Remedy
4082	A communication fault has occurred when attempting to acknowledge the current unit. In most cases, you will receive other system messages which provide more information about the cause of the communication problems. Attempt to acknowledge the unit again.

A.1.6 No Unit Capable of Acknowledgement Selected

Message Number	Cause/Remedy
4083	This message appears if you attempt to acknowledge a unit when no unit capable of being acknowledged is selected. That will be the case if • the Message Screen is open but no diagnosable message is selected on it. • the Overview Screen is open but the unit selected on it does not offer an acknowledgement bit.

A.2 Overview Screen System Messages

A.2.1 Error Identifying Faults on a Unit

Message Number	Cause/Remedy
4021	The list of active steps and/or steps with faults could not be read from the PLC. The cause is generally a communication fault between the operating unit and the PLC. In most cases, you will receive other system messages which provide more information about the cause of the fault. This might be such things as faulty connectors, a modified program on the PLC or insufficient memory on the operating unit.

A.2.2 Not Enough Memory for Display in Fault Mode

Message Number	Cause/Remedy
4022	There is not enough memory available on the operating unit to switch to fault mode on the Overview Screen. The change of mode is not carried out. The standard mode remains active. The cause is generally use of large amounts of memory by OEM functions invoked. Try the operation again at another time.

A.2.3 Error Identifying Faulty Units

Message Number	Cause/Remedy
4023	The next unit with a fault could not be identified in fault mode on the Overview Screen. The highlight is repositioned on the first unit. The cause is generally a communication fault between the operating unit and the PLC. In most cases, you will receive other system messages which provide more information about the cause of the fault. This might be such things as faulty connectors, a modified program on the PLC or insufficient memory on the operating unit.

A.2.4 No Units Capable of Diagnosis Present

Message Number	Cause/Remedy
4024	This message appears when the Overview Screen is opened if there are no diagnosable units on the configured system. If necessary, modify your PLC program accordingly using one of the STEP 7 language packages, translate it and download it to the PLC. In ProTool, choose the menu option *System* → *ProAgent*.

A.3 Detail Screen System Messages

A.3.1 No Faulty Unit Selected

Message Number	Cause/Remedy
4041	This message appears when the Detail Screen is opened if • the Detail Screen is called up from the Message Screen but the selected unit is not diagnosable. • the Detail Screen is called up from a blank Overview Screen. • the Detail Screen is called up from the Overview Screen but none of the steps has a fault (if PLC programmed in S7-GRAPH). • a communication fault or temporary shortage of memory has occurred.

A.3.2 No Faulty Action Present

Message Number	Cause/Remedy
4042	This message appears when the Detail Screen is opened if • the Detail Screen is called up from the Message Screen but the fault has since departed again. • the Detail Screen is called up from the Overview Screen but the selected unit does not have a fault. • the function `ProAgent: Change Action` has been used to change to the unit with a fault but there are no more actions. • a communication fault or temporary shortage of memory has occurred.

A.3.3 Error Identifying Transitions in Fault Mode

Message Number	Cause/Remedy
4043	It has not been possible to read from the PLC which transition was taking place at the time of occurrence of the fault. This message can only appear in the case of PLCs whose program is written in S7-HiGraph. The cause is generally a communication fault between the operating unit and the PLC. In most cases, you will receive other system messages which provide more information about the cause of the fault. This might be such things as faulty connectors or changed addresses on the PLC.

A.3.4 Error Identifying Signal Statuses

Message Number	Cause/Remedy
4044	The Detail Screen is in the "Show current status bits display mode"; however, only the status bits at the time of occurrence of the fault can be read from the PLC. Current status bits are only provided by S7-GRAPH.

A.3.5 Error Determining Initial Values

Message Number	Cause/Remedy
4045	The Detail Screen is in the "Show initial values" display mode; however, the status of the signals at the time of occurrence of the fault can not be read from the PLC. The cause is generally a communication fault between the operating unit and the PLC. In most cases, you will receive other system messages which provide more information about the cause of the fault. This might be such things as faulty connectors or changed addresses on the PLC.

A.4 Movement Screen System Messages

A.4.1 No Current Unit Selected

Message Number	Cause/Remedy
4061	This message appears when the Movement Screen is opened if • the Movement Screen is called up from the Message Screen but the selected unit is not diagnosable. • the Movement Screen is called up from a blank Overview Screen. • a communication fault or temporary shortage of memory has occurred.

A.4.2 Error Enabling or Disabling Movements

Message Number	Cause/Remedy
4062	A communication fault or temporary shortage of memory has occurred when attempting to enable or disable a movement. These situations can occur when • the system is being started up • the Movement Screen is selected • scrolling within the Movement Screen Repeat the action.

A.4.3 Error Determining Limit Number

Message Number	Cause/Remedy
4063	The number of defined target positions could not be read from the PLC. The cause is generally a communication fault between the operating unit and the PLC. In most cases, you will receive other system messages which provide more information about the cause of the fault. This might be such things as faulty connectors, a modified program on the PLC or insufficient memory on the operating unit.

A.5 Step Screen System Messages

A.5.1 No Valid Step Selected

Message Number	Cause/Remedy
4084	You have specified a step number that does not exist in the sequencer displayed. Specify an existing step number.

A.5.2 No S7-GRAPH Unit Selected

Message Number	Cause/Remedy
4085	You have attempted to open the step screen from the overview screen, but no unit had been selected in the overview screen that had been programmed in S7-GRAPH. The step screen is indeed displayed but a step number cannot be entered. Go back to the overview screen and select a suitable unit.

Appendix System Limits

B

Overview

The appendix contains information about the memory requirement of projects, in the basis of which you can assess whether or not the memory of your operating unit is large enough for the intended configuration.

On the basis of a concrete example, you are shown how the memory requirement for a project is determined. This will then enable you to apply this knowledge to your own projects.

B.1 System Limits (Introduction)

Whether or nor your diagnosis project runs on the operating unit being used depends among other things on how much memory space the diagnosis requires. In this context, you have to take two system limits into account:

- First of all you have to ensure that the diagnosis structures do not exceed a specified total number and do not exceed a size of 64 kbytes. This limit applies to all operating units.
- Another system limit concerns the size of the DRAM available. In the case of an OP 25, this is for example only 2 Mbytes, of which the operating system requires 1 Mbyte. This leaves just 1 Mbyte for configurations.

Tip
The precise technical data of the operating unit you are using can be found in the Appendix of the respective equipment manual.

It is difficult to calculate the amount of memory required for diagnosis precisely in advance, since the various diagnosis data are dependent on each other. You will however find below a listing of how much memory space potential components of a project may each take up.

Not taken into account in the listing are more far-reaching configuration data for visualization of the installation.

On the basis of the general specifications and the current figures from your project, you can estimate your minimum requirement for memory space. How this is done is explained in a concrete calculation example.

B.2 System Limits of the Diagnosis

Independent of the operating unit, a diagnosis must comply with the following system limits:

- The diagnosis structures used must not exceed the following quantity limitations:

Structures	Max. number
S7-PDIAG unit (incl. subunits) or S7-GRAPH step sequences	65
Total number of messages (with and without analysis of criteria), of which messages with analysis of criteria or S7-GRAPH steps or transitions	2 000 600
Simultaneously pending messages	200
Criteria per analysis of criteria	64
Total number of criteria	24 000

- Overall, the diagnosis structures must take up no more than 64 kbytes of memory space.

  The memory requirement of the diagnosis structures of a project depends on which and how many of the structures listed below you use.

S7-PDIAG Structures	Memory requirement per unit
S7-PDIAG block	130 bytes
Network	80 bytes
Movement	35 bytes
Target position	5 bytes

S7-Graph Structures	Memory requirement per unit
S7-Graph step sequence	130 bytes
S7-Graph step	80 bytes
S7-Graph transition	80 bytes

How you can determine whether or not the system limits are complied with is explained by the calculation example.

B.3 DRAM Requirement of the Project Components

On a number of operating units, e.g. the OP 25, only 1 Mbyte of the DRAM is available for projects. Projects that are to run on these operating units must therefore require no more than 1 Mbyte of DRAM.

Irrespective of the layout of the project there is a fixed basic requirement for memory, since certain components must always be integrated into any project.

Component	Requirement
Operating system	1 Mbyte
Basic configuration (standard ProTool/ProAgent screens)	200 kbytes
Maximum basic requirement for diagnosis	200 kbytes

Depending on your diagnosis project (STEP 7), the basic requirement for the diagnosis can also be below 200 kbytes. More far-reaching configuration data for visualization of the installation have not been taken into account in the basic requirement.

The amount of memory your project will require on top of the basic requirement depends on which and how many of the components listed below you use.

Component	Maximum number	Requirement per component
User diagnosis texts – S7-PDIAG: maximum of 40 characters per unit, network, movement and target position text – S7-GRAPH: maximum of 40 characters per step sequence, step and transition	1 600 texts	1 byte per character, maximum of 40 bytes monolingual 1 byte per character, i.e. maximum of 40 bytes monolingual
Analysis of Criteria – Basic requirement per criterion – Remark texts, maximum of 40 characters – Symbolism texts, maximum of 40 characters	24 000 criteria	15 bytes 1 byte per character, maximum of 40 bytes monolingual 1 byte per character, maximum of 40 bytes

Alarm messages – Texts, maximum of 80 characters	2 000 alarm messages	1 byte per character, maximum of 80 bytes monolingual
– Help texts, maximum of 245 characters		1 byte per character, maximum of 245 bytes monolingual

In multilingual projects you must multiply the memory requirement for the texts by the number of languages.

What you therefore have to know for your project is the:

- number of components
- type of components
- scope of the associated texts.

On the basis of this, you can approximately estimate whether the memory of your operating unit is large enough for the planned project. The calculation example can serve as a sample.

B.4 How Can You Save on Memory Space?

If your configuration requires more memory space than is available on the operating unit being used, make the texts shorter.

If your configuration still won't fit in the memory of the operating unit, the only option left open to you is to use an operating unit with a larger memory.

B.5 Calculation Example: Memory Requirement of an OP25 Project

Basic Requirements

The project planned encompasses the following components:

- **S7-PDIAG**

  20 units

  300 networks

  20 movements

  320 target positions (16 per movement)

- **S7-Graph**

  10 step sequences

  150 steps (15 per step sequence)

  150 transitions (15 per step sequence)

- **Miscellaneous**

  10 000 initial values, signals or criteria

  1 300 alarm messages

- **Text lengths**

  Target position texts: 40 bytes each

  All other texts: 20 bytes each

- **1 language**

Memory Requirement of the Diagnosis Structures

The memory requirement of the diagnosis structures is calculated as follows:

Structure	Number	Bytes	Number*Bytes
S7-PDIAG			
Units	20	130	2 600
networks	300	80	24 000
Movements	20	35	700
Target Positions	320	5	1 600
S7-Graph			
Step sequences	10	130	1 300
Steps	150	80	12 000
Transitions	150	80	12 000
Sum			**54 200**

The diagnosis structures require a total of 54 200 bytes. The system limit of 64 000 bytes is therefore complied with.

At the end of this Appendix you will find a blank form on which you can easily calculate the memory requirement of your own project. You can also print out the same form from the *Online Help for ProAgent*.

DRAM Requirement of the Project Components

The memory requirement of the components that make up the example project is calculated as follows:

Component	Number	Bytes	Language	Number*Bytes *Languages
Basic Requirement				
Basic configuration (standard ProTool/ProAgent screens)	1	approx. 200 000	---	approx. 200 000
Basic requirement for diagnosis	1	approx. 200 000	---	approx. 200 000
User Diagnosis Texts				
1 text per S7-PDIAG block	20	20	1	400
2 texts per network	500	20	1	10 000
2 texts per movement	40	20	1	800
1 text per target position	320	40	1	12 800
1 text per S7-Graph step sequence	10	20	1	200
2 texts per step	300	20	1	6 000
2 texts per transition	300	20	1	6 000
Analysis of Criteria				
Basic requirement for structure	10 000	15	---	150 000
Remark texts	10 000	20	1	200 000
Symbolism texts	10 000	20	---	200 000
Alarm messages				
Message texts	1 300	20	1	26 000
Help texts	0	0	1	0
Sum				**1 012 200**

At an estimate, the project requires 1 012 200 bytes of memory space. The system limit of 1 Mbyte (1 048 576 bytes) is therefore complied with. Please note that the result calculated is an estimate that is accurate only to within approximately 100 kbytes.

At the end of this Appendix you will find a blank form on which you can easily calculate the memory requirement of your own project. You can also print out the same form from the *Online Help for ProAgent*.

B.6 Form: Memory Requirement of the Diagnosis Structures

The "Structure" and "Bytes" columns already contain all diagnosis structures and their memory requirement.

1. In the 3rd column enter how often you use each structure.
2. In the 4th column, "Number*Bytes", calculate the memory requirement of each type of structure.
3. Add up the values in the 4th column to calculate the overall memory requirement.

   The result must be less than 64 000 bytes.

Structure	Bytes	Number	Number*Bytes
S7-PDIAG			
Units	130		
networks	80		
Movements	35		
Target Positions	5		
S7-Graph			
Step sequences	130		
Steps	80		
Transitions	80		
Sum			

B.7 Form: DRAM Requirement of the Project Components

The "Component" and "Max. bytes" columns already contain all project components and their maximum memory space.

1. In the 3rd column enter how often you use each component.
2. In the 4th column, "Byte", enter how many bytes the components you are using actually take up.
3. In the 5th column enter the number of languages. A "–" has already been entered for components whose memory requirement is independent of the language being used.
4. In the 6th column, "Number*Bytes*Languages", calculate the memory requirement of each component class.
5. Add up the values in the 6th column to calculate the overall memory requirement.

   The result must be less than 1 Mbyte (1 048 576 bytes).

Component	Max. Bytes	Number	Bytes	Language	Number *Bytes *Languages
Basic Requirement					
Basic configuration (standard ProTool/ProAgent screens)	200 000	1	200 000	---	200 000
Basic requirement for diagnosis	200 000	1	200 000	---	200 000
User Diagnosis Texts					
1 text per S7-PDIAG block	40				
2 texts per network	40				
2 texts per movement	40				
1 text per target position	40				
1 text per S7-Graph step sequence	40				
2 texts per step	40				
2 texts per transition	40				

Analysis of Criteria					
Basic requirement for structure	15			---	
Remark texts	40				
Symbolism texts	40			---	
Alarm messages					
Message texts	80				
Help texts	245				
Sum					

SIMATIC HMI Documentation

C

Target groups

This manual is part of the SIMATIC HMI documentation. The documentation is aimed at the following target groups:

- Newcomers
- Users
- Configurers
- Programmers
- Commissioning engineers

How the documentation is organized

The SIMATIC HMI documentation consists of the following components:

- User’s Guides / User’s Manuals for:
  - Configuration software
  - Runtime software
  - Communication between PLCs and operating units
- Equipment Manuals for the following operating units:
  - MP (Multi Panel)
  - OP (Operator Panel)
  - TP (Touch Panel)
  - TD (Text Display)
  - PP (Push Button Panel)
- Online Help on the configuration software
- Start-up Guides
- First Steps

Overview of complete documentation

The following table provides an overview of the SIMATIC HMI documentation and shows you when you require the different documents.

Documentation	Target Group	Content
First Steps with ProTool Product Brief	Newcomers	This documentation guides you step by step through the configuration of • a screen with various objects • changing from one screen to another • a message. This documentation is available for: • OP3, OP5, OP7, OP15, OP17 • OP25, OP27, OP35, OP37, TP27, TP37 • Windows–based systems
ProTool Configuring Windows–based Systems User's Guide	Configurers	Provides information on working with the ProTool/Pro configuration software. It contains • information on installation • basic principles of configuration • a detailed description of configurable objects and functions. This documentation is valid for Windows–based systems.
ProTool Configuring Graphics Displays User's Guide	Configurers	Provides information on working with the ProTool configuration software. It contains • information on installation • basic principles of configuration • a detailed description of configurable objects and functions. This documentation is valid for graphic display operating units.

Documentation	Target Group	Content
ProTool Configuring Text–based Displays User's Guide	Configurers	Provides information on working with the ProTool/Lite configuration software. It contains • information on installation • basic principles of configuration • a detailed description of configurable objects and functions. This documentation is valid for text–based display operating units.
ProTool Online Help	Configurers	Provides information on the configuration computer while working with ProTool. Online Help contains • context–sensitive help • detailed instructions and examples • detailed information • all the information from the user guide.
ProTool/Pro Runtime User's Guide	Commissioning engineers, Users	Provides information on working with ProTool/Pro Runtime software. It contains • installation of the ProTool/Pro Runtime visualization software • commissioning and running the software on Windows–based systems.
Copy Protection Start-up Guide	Commissioning engineers, Users	The ProTool/Pro Runtime visualization software is a copyright product. This manual contains information on the installation, repair and uninstallation of authorizations.

Documentation	Target Group	Content
Application Example Start-up Guide	Newcomers	ProTool is supplied with example configurations and the corresponding PLC programs. This documentation describes how you • load the examplesonto the operating unit and PLC • run the examples and • upgrade the connection to the PLC to suit your own specific application.
MP270 Equipment Manual	Commissioning engineers, Users	Describes the hardware and the general operation of Multi Panel MP270. It contains • installation and commissioning instructions • a description of the equipment • operating instructions • instructions for connecting the PLC, printer and programming computer, • maintenance instructions.
OP37/Pro Equipment Manual	Commissioning engineers, Users	Describes the hardware, installation and inclusion of upgrades and options for the OP37/Pro.
TP27, TP37 Equipment Manual OP27, OP37 Equipment Manual OP25, OP35, OP45 Equipment Manual OP7, OP17 Equipment Manual OP5, OP15 Equipment Manual TD17 Equipment Manual	Commissioning engineers, Users	Describes the hardware and general operation. It contains • installation and commissioning instructions • operating unit description • connecting the PLC, printer and programming computer • operating modes • operation • description of the standard screens supplied with the operating unit and how to use them • fitting options • maintenance and fitting of spare parts.

Documentation	Target Group	Content
OP3 Equipment Manual	Commissioning engineers, Users, Programmers	Describes the hardware of the OP3, its general operation and the connection to the SIMATIC S7.
PP7, PP17 Equipment Manual	Commissioning engineers, Users	Describes the hardware, installation and commissioning of push–button panels PP7 and PP17.
Communication User's Manual	Programmers	Provides information on connecting text–based and graphics displays to the following PLCs: • SIMATIC S5 • SIMATIC S7 • SIMATIC 500/505 • drivers for other PLCs This documentation describes the • configuration and parameters required for connecting the devices to the PLC and the network • user data areas used for exchanging data between operationg unit and PLC.
Communication for Windows–based Systems User's Manual	Programmers	Provides information on connecting Windows–based systems to the following PLCs: • SIMATIC S5 • SIMATIC S7 • SIMATIC 505 • Allen Bradley PLC 5/SLC 500 This documentation describes the • configuration and parameters required for connecting devices to the PLC and the network • user data areas used for exchanging data between operating unit and PLC.

Documentation	Target Group	Content
Other PLCs Online Help	Programmers	Provides information on connecting devices to PLCs, such as: • Mitsubishi • Allen Bradley • Telemecanique • Modicon • Omron • SIMATIC WinAC When the drives are installed, the relevant Online Help is installed at the same time.
ProAgent for OP User's Manual	Configurers	Provides the following information about the ProAgent optional package (process diagnosis) for OPs • configuring system–specific process diagnosis • detecting, locating the cause of and eliminating process errors, • customizing standard diagnostic screens supplied with the software.

Siemens worldwide

D

In this Appendix

In this appendix you will find a list of:

- All cities in the Federal Republic of Germany with Siemens Sales Offices and
- All European and non-European Siemens Companies and Representatives.

Siemens Sales Offices in the Federal Republic of Germany

The following table lists all Siemens Sales Offices in the Federal Republic of Germany.

Aachen
Augsburg
Bayreuth
Berlin
Bielefeld
Bonn
Braunschweig
Bremen
Chemnitz
Darmstadt
Dortmund
Dresden
Duisburg
Düsseldorf
Erfurt
Essen
Frankfurt a.M.
Freiburg
Hamburg
Heilbronn
Karlsruhe
Kassel
Kempten/Allg.
Kiel
Koblenz
Köln
Konstanz
Laatzen
Leipzig
Lingen
Magdeburg
Mainz
Mannheim
München
Münster/Westf.
Nürnberg
Osnabrück
Regensburg
Rostock
Saarbrücken
Siegen
Stuttgart
Ulm
Wetzlar
Wilhelmshaven
Wuppertal
Würzburg

European Companies and Representatives

The following table lists all European Siemens Companies and Representatives.

Austria
Siemens AG Österreich
- Bregenz
- Graz
- Innsbruck
- Linz
- Salzburg
- Wien

Belgium
Siemens S.A.
- Bruxelles
- Liège

Siemens N. V.
- Antwerpen

Bosnia-Herzegovina
Generalexport Predstavnistvo Sarajevo
- Sarajevo

Bulgaria
Siemens AG, rappresentanza in Bulgaria
- Sofia

Croatia
Siemens d. o. o.
- Zagreb

Cyprus
GEVO Ltd.
oppure
Jolali Ltd.
- Nicosia

Czech Republic
Siemens AG
- Brno
- Mladá Boleslav
- Praha

Denmark
Siemens A/S
- Koebenhavn, Ballerup

Finland
Siemens Oy
- Espoo, Helsinki

France
Siemens S.A.
- Haguenau
- Lille, Seclin
- Lyon, Caluire–et–Cuire
- Marseille
- Metz
- Paris, Saint–Denis
- Strasbourg
- Toulouse

Great Britain
Siemens plc
- Birmingham, Walsall
- Bristol, Clevedon
- Congleton
- Edinburgh
- Glasgow
- Leeds
- Liverpool
- London, Sunbury–on–Thames
- Manchester
- Newcastle

Greec
Siemens A.E.
- Athen, Amaroussio
- Thessaloniki

Hungaria
Siemens Kft
- Budapest

Iceland
Smith & Norland H/F
- Reykjavik

Ireland
Siemens Ltd.
- Dublin

Italy
Siemens S.p.A.
- Bari
- Bologna
- Brescia
- Casoria
- Firenze
- Genova
- Milano
- Padova
- Roma
- Torino

Luxemburg
Siemens S.A.
- Luxembourg

Malta
J. R. Darmanin & Co. Ltd.
- Valletta

Netherlands
Siemens Nederland N.V.
- Den Haag
- Rijswijk

Norway
Siemens A/S
- Bergen
- Oslo
- Stavanger
- Trondheim

Poland
Siemens GmbH
- Gdansk–Letnica
- Katowice
- Warszawa

Portugal
Siemens S.A.
- Albufeira
- Coímbra
- Lisboa, Amadora
- Matosinhos
- Porto

Romania
Siemens birou de consultatii tehnice
- Bucuresti

Russia
Siemens AG
oppure
Mosmatic
- Moskau

Siemens AG
- Ekaterinburg

Slovak Republic
Siemens AG
- Bratislava

Slovenia
Siemens d. o. o.
- Ljubljana

Spain
Siemens S.A.
- Barcelona
- Bilbao
- Gijón
- Granada
- La Coruña
- Las Palmas de Gran Canaria
- León
- Madrid
- Málaga
- Murcia
- Palma de Mallorca
- Pamplona
- Sevilla
- Valencia
- Valladolid
- Vigo
- Zaragoza

Sweden
Siemens AB
- Göteborg
- Jönköping
- Malmö
- Sundsvall
- Upplands Väsby, Stockholm

Switzerland
Siemens–Albis AG
- Basel
- Bern
- Zürich

Siemens–Albis S.A.
- Renens, Lausanne

Turkey
SIMKO
- Adana
- Ankara
- Bursa
- Istanbul
- Izmir
- Samsun

Ukraine
Siemens AG
- Kiew

Non-European Companies and Representatives

The following table lists all non?European Siemens Companies and Representatives of Siemens AG.

Africa

The following table lists all Siemens Companies and Representatives of Siemens AG in Africa.

Algeria
Siemens Bureau d'Alger
- Alger

Angola
TECNIDATA
- Luanda

Bophuthatswana
Siemens Ltd.
- Mafekeng

Egypt
Siemens Technical Office
- Cairo–Mohandessin

Siemens Technical Office
- Alexandria

EGEMAC S.A.E.
- Cairo–Mattaria

Ethiopia
Addis Electrical Engineering Ltd.
- Addis Abeba

Ivory Coast
Siemens AG
- Abidjan

Libya
Siemens AG, Branch Libya
- Tripoli

Marocco
SETEL
Société Electrotechnique et de Télécommunications S.A.
- Casablanca

Mozambique
Siemens Liaison Office
- Maputo

Namibia
Siemens (Pty.) Ltd.
- Windhoek

Nigeria
Electro Technologies Nigeria Ltd. (ELTEC)
- Lagos

Rwanda
Etablissement Rwandais
- Kigali

Sambia
Electrical Maintenance Lusaka Ltd.
- Lusaka

Simbabwe
Electro Technologies Corporation (Pvt.) Ltd. (ETC)
- Harare

South Africa
Siemens Ltd.
- Cape Town
- Durban
- Johannesburg
- Middelburg
- Newcastle
- Port Elizabeth
- Pretoria

Sudan
National Electrical & Commercial Company (NECC)
- Khartoum

Swaziland
Siemens (Pty.) Ltd.
- Mbabane

Tanzania
Tanzania Electrical Services Ltd.
- Dar–es–Salaam

Tunesia
Sitelec S.A.
- Tunis

Zaire
SOFAMATEL S.P.R.L.
- Kinshasa

America

The following table lists all Siemens Companies and Representatives of Siemens AG in America.

Argentina
Siemens S.A.
- Bahía Blanca
- Buenos Aires
- Còrdoba
- Mendoza
- Rosario

Bolivia
Sociedad Comercial é Industrial Hansa Ltda.
- La Paz

Brazil
Siemens S.A.
- Belém
- Belo Horizonte
- Brasilia
- Campinas
- Curitiba
- Fortaleza
- Pôrto Alegre
- Recife
- Rio de Janeiro
- Salvador de Bahia
- São Paulo
- Vitória

Canada
Siemens Electric Ltd.
- Montreal, Québec
- Toronto

Chile
INGELSAC
- Santiago de Chile

Colombia
Siemens S.A.
- Barranquilla
- Bogotá
- Cali
- Medellín

Costa Rica
Siemens S.A.
- Panama
- San José

Cuba
Respresentación
Consult iva EUMEDA
- La Habana

Ecuador
Siemens S.A.
- Quito

El Salvador
Siemens S.A.
- San Salvador

Guatemala
Siemens S.A.
- Ciudad de Guatemala

Honduras
Representaciones Electroindustriales S de R.L. - Relectro
- Tegucigalpa

Mexico
Siemens S.A. de CV
- Culiacán
- Gómez Palacio
- Guadalajara
- León
- México, D.F.
- Monterrey
- Puebla

Nicaragua
Siemens S.A.
- Managua

Paraguay
Rieder & Cia. S.A.C.I.
- Asunción

Peru
Siemsa
- Lima

United States of America
Siemens Energy & Automation Inc.
Automation Division
- Alpharetta, Georgia

Numeric Motion Control
- Elk Grove Village, Illinois

Uruguay
Conatel S.A.
- Montevideo

Venezuela
Siemens S.A.
- Caracas
- Valencia

Asia

The following table lists all Siemens Companies and Representatives of Siemens AG in Asia.

Bahrain
Transitec Gulf
- Manama

Bangladesh
Siemens Bangladesh Ltd.
- Dhaka

Brunei
- Brunei Darussalam

Hong Kong
Siemens Ltd.
- Hong Kong

India
Siemens Limited
- Ahmedabad
- Bangalore
- Bombay
- Calcutta
- Madras
- New Delhi
- Secúnderabad

Indonesia
P.T. Siemens Indonesia, P.T. Siemens Dian–Grana Elektrika, Representative Siemens AG
- Jakarta

Iraq
Samhiry Bros. Co. Limited
oder
Siemens AG (Iraq Branch)
- Baghdad

Iran
Siemens S.S.K.
- Teheran

Japan
Siemens K.K.
- Tokyo

Korea
Siemens Ltd.
- Changwon
- Seoul
- Ulsan

Kuwait
National & German Electrical and Electronic Services Co. (NGEECO)
- Kuwait, Arabia

Lebanon
Ets. F.A. Kettaneh S.A.
- Beyrouth

Malaysia
Siemens Electrical Engineering Sdn. Bhd.
- Kuala Lumpur

Nepal
Amatya Enterprises (Pvt.) Ltd.
- Kathmandu

Oman
Waleed Associates
- Muscat

Pakistan
Siemens Pakistan Engineering Co., Ltd.
- Islamabad
- Karachi
- Lahore
- Peshawar
- Quetta

People's Republic of China
Siemens AG Representation
- Beijing
- Guangzhou
- Shanghai

Philippine Islands
Maschinen & Technik Inc. (MATEC)
- Manila

Qatar
Trags Electrical Engineering and Air Conditioning Co.
- Doha

Saudi Arabia
Arabia Electric Ltd. (Equipment)
- Al–Khobar
- Jeddah
- Riyadh

Singapore
Siemens (Pte.) Ltd.
- Singapore

Sri Lanka
Dimo Limited
- Colombo

Syria
Siemens AG, Branch (A.S.T.E.)
- Damascus

Taiwan
Siemens Ltd., TELEUNION Engineering Ltd.
oder
TAI Engineering Co., Ltd.
- Taichung
- Taipei

Thailand
Berti Jucker Co. Ltd.
- Bangkok

United Arab Emirates
Electro Mechanical Co.
oder
Siemens Resident Engineers
- Abu Dhabi

Scientechnic
oder
Siemens Resident Engineers
- Dubai

Vietnam
OAV Representative Office
- Hanoi

Yemen (Arab. Republic)
Tihama Tractors & Engineering Co., Ltd.
oder
Siemens Resident Engineers
- Sanaa

Australia

The following table lists all Siemens Companies and Representatives of Siemens AG in Australia.

Australia
Siemens Ltd.
- Adelaide
- Brisbane
- Melbourne
- Perth
- Sydney

New Zealand
Siemens Ltd.
- Auckland
- Wellington

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